

FBISE

BIOLOGY

MODEL PAPERS & GUESS PAPERS

Federal Board Islamabad

Presented by:

Urdu Books Whatsapp Group

STUDY GROUP

**9TH
CLASS**

0333-8033313

راؤ ایاز

0343-7008883

پاکستان زندہ باد

0306-7163117

محمد سلمان سلیم

Chapter # 1

Introduction to Biology

Topics Included:

- Introduction to Biology (2-3)
- Branches of Biology
- The Levels Of Organization (7-13)

GUESS PAPER & MODEL PAPER # 1 BASED ON CHAPTER # 1 (Reduced Syllabus) INTRODUCTION TO BIOLOGY

BIOLOGY SSC-I SECTION-A

Time allowed: 20 Minutes

Marks: 12

NOTE:- Section-A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 20 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q.1 Encircle the correct option i.e. A / B / C / D. All parts carry equal marks.

- If a scientist is studying the methods of inserting human insulin gene in bacteria, which branch of biology may this be:
A. Anatomy B. Physiology C. Biotechnology D. Pharmacology
- Members of the same species living in the same place at the same time make a;
A. Habitat B. Biosphere C. Community D. Population
- Which one will be the correct sequence of the levels of organization of life?
A. Cell, organelle, molecule, organ, tissue, organ system, individual
B. Molecule, tissue, organelle, cell, organ system, organ, individual
C. Molecule, organelle, cell, tissue, organ, organ system, individual
D. Organ system, organ, tissue, cell, molecule, organelle, individual
- Which of these major bioelements is in the highest percentage in protoplasm?
A. Carbon B. Hydrogen C. Oxygen D. Nitrogen
- Which of the following group includes organisms all of which are absorptive in their nutrition?
A. Protists B. Animals C. Bacteria D. Fungi
- Similar cells organized into groups and performing same functions are known as;
A. Organelle B. Tissue C. Organ D. Organdy stem
- Which of these tissues also makes the glandular tissue in animals?
A. Epithelial tissue B. Muscular tissue
C. Connective tissue D. Nervous tissue
- The level of organization that is less definite in plants is;
A. Tissue level B. Organ level
C. Organ system level D. Individual level
- What is TRUE about volvox?
A. Unicellular eukaryote B. Unicellular eukaryote

Chapter # 01

Introduction to Biology

Guess Papers

- x. When we study the feeding relations among different animal species of a forest, at what level of organization we are studying?
A. Individual B. Population C. Community D. Biosphere
- xi. A green alga found in water that shows colonial organization:
A. Euglena B. Paramecium C. Amoeba D. Volvox
- xii. Group of tissues doing a particular job is called:
A. Cell B. System C. Organ D. Organelle

BIOLOGY SSC-I

Time allowed: 2:40 Hours

Total Marks: 53

NOTE: Answer any six parts from Section 'B' and attempt any five parts from Section-C. Attempt any two questions from Section 'D' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

SECTION-B (Marks 18)

- Q.2 Attempt any SIX parts from the following. All parts carry equal marks. Be brief and to the point. (6 × 3 = 18)
- (i) Arrange these structures in order of lower level of organization to upper level and write the level against each structure. Neuron, nervous system, electron, man, mass of neurons, carbon, mitochondria, brain, protein.
 - (ii) How would you define biology and relate it with its major Divisions?
 - (iii) How would you distinguish the biomolecules from other molecules? What is the criterion for classifying a biomolecule as micromolecule or macromolecule?
 - (iv) Is there any division of labour among the cells of a colony? If you find division of labour among the cells and tissue what level of cellular organization is it?
 - (v) Define science?
 - (vi) What Dr. Abdul Salam told about scientific knowledge?
 - (vii) Describe the division of living organisms into different groups in biology?
 - (viii) Define Community?

SECTION-C (Marks 15)

- Q.3 Attempt any FIVE parts from the following. All parts carry equal marks. Be brief and to the point. (5 × 3 = 15)
- (i) Which are not the subject of biotechnology?
 - (ii) Which are the major biological issues today?
 - (iii) Draw a linkage table which describe parameters of study at different levels of biological organization?
 - (iv) Describe the structure of an atom?
 - (v) Enlist the vital organs which can be damage by notorious diseases?
 - (vi) Describe the organelles present in Prokaryotes and Eukaryotes.
 - (vii) Describe the Functions of digestive organs and sum up processes of digestive system?

SECTION-D (Marks 20)

Note: Attempt any TWO questions. All questions carry equal marks.

(2 × 10 = 20)

ختم نبوت ﷺ زندہ باد

السلام علیکم ورحمۃ اللہ وبرکاتہ:

معزز ممبران: آپ کا وٹس ایپ گروپ ایڈمن "اردو بکس" آپ سے مخاطب ہے۔

آپ تمام ممبران سے گزارش ہے کہ:

- ❖ گروپ میں صرف PDF کتب پوسٹ کی جاتی ہیں لہذا کتب کے متعلق اپنے کمٹس / ریویوز ضرور دیں۔ گروپ میں بغیر ایڈمن کی اجازت کے کسی بھی قسم کی (اسلامی و غیر اسلامی، اخلاقی، تحریری) پوسٹ کرنا سختی سے منع ہے۔
- ❖ گروپ میں معزز، پڑھے لکھے، سلجھے ہوئے ممبرز موجود ہیں اخلاقیات کی پابندی کریں اور گروپ رولز کو فالو کریں بصورت دیگر معزز ممبرز کی بہتری کی خاطر ریموو کر دیا جائے گا۔
- ❖ کوئی بھی ممبر کسی بھی ممبر کو انباکس میں میسج، مس کال، کال نہیں کرے گا۔ رپورٹ پر فوری ریموو کر کے کارروائی عمل میں لائے جائے گی۔
- ❖ ہمارے کسی بھی گروپ میں سیاسی و فرقہ واریت کی بحث کی قطعاً کوئی گنجائش نہیں ہے۔
- ❖ اگر کسی کو بھی گروپ کے متعلق کسی قسم کی شکایت یا تجویز کی صورت میں ایڈمن سے رابطہ کیجئے۔
- ❖ سب سے اہم بات:

گروپ میں کسی بھی قادیانی، مرزائی، احمدی، گستاخِ رسول، گستاخِ امہات المؤمنین، گستاخِ صحابہ و خلفائے راشدین حضرت ابو بکر

صدیق، حضرت عمر فاروق، حضرت عثمان غنی، حضرت علی المرتضیٰ، حضرت حسنین کریمین رضوان اللہ تعالیٰ اجمعین، گستاخِ اہلبیت یا

ایسے غیر مسلم جو اسلام اور پاکستان کے خلاف پراپیگنڈا میں مصروف ہیں یا ان کے روحانی و ذہنی سپورٹرز کے لئے کوئی گنجائش نہیں

ہے لہذا ایسے اشخاص بالکل بھی گروپ جو ان کرنے کی زحمت نہ کریں۔ معلوم ہونے پر فوراً ریموو کر دیا جائے گا۔

❖ تمام کتب انٹرنیٹ سے تلاش / ڈاؤنلوڈ کر کے فری آف کاسٹ وٹس ایپ گروپ میں شیئر کی جاتی ہیں۔ جو کتاب نہیں ملتی اس کے لئے معذرت کر

لی جاتی ہے۔ جس میں محنت بھی صرف ہوتی ہے لیکن ہمیں آپ سے صرف دعاؤں کی درخواست ہے۔

❖ عمران سیریز کے شوقین کیلئے علیحدہ سے عمران سیریز گروپ موجود ہے۔

❖ لیڈیز کے لئے الگ گروپ کی سہولت موجود ہے جس کے لئے ویریفیکیشن ضروری ہے۔

❖ اردو کتب / عمران سیریز یا سٹیڈی گروپ میں ایڈ ہونے کے لئے ایڈمن سے وٹس ایپ پر بذریعہ میسج رابطہ کریں اور جواب کا انتظار فرمائیں۔ برائے

مہربانی اخلاقیات کا خیال رکھتے ہوئے موبائل پر کال یا ایم ایس کرنے کی کوشش ہرگز نہ کریں۔ ورنہ گروپس سے توریوو کیا ہی جائے گا بلاک بھی کیا

جائے گا۔

نوٹ: ہمارے کسی گروپ کی کوئی فیس نہیں ہے۔ سب فی سبیل اللہ ہے

0333-8033313

راؤ ایاز

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پاکستان زندہ باد

اللہ تبارک تعالیٰ ہم سب کا حامی و ناصر ہو

0306-7163117

محمد سلمان سلیم

پاکستان زندہ باد

SOLUTION OF GUESS PAPER & MODEL PAPER # 1 (Reduced Syllabus)

SECTION- A (MCQs)

i. C	ii. D	iii. C	iv. C	v. D	vi. B
vii. A	viii. C	ix. C	x. C	xi. D	xii. C

SECTION-B (Marks 18)

Time allowed: 2:40 Hours

Total Marks: 53

NOTE: Answer any six parts from Section 'B' and attempt any five parts from Section-C. Attempt any two questions from Section 'D' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

Q.2 Attempt any SIX parts from the following. All parts carry equal marks. Be brief and to the point. (6 × 3 = 18)

(i) Arrange these structures in order of lower level of organization to upper level and write the level against each structure. Neuron, nervous system, electron, man, mass of neurons, carbon, mitochondria, brain, protein.

Ans: Arrangement of structures in order of lower level of organization to upper level:

Structures	Level of Organization
1. Electron	Sub-atomic level
1. Carbon	Atomic level
2. Protein	Molecular level
3. Mitochondria	Organelle level
4. Neuron	Cell level
5. Mass of neurons	Tissue level
6. Brain	Organ level
7. Nervous System	Organ system level
8. Man	Individual level

(ii) How would you define biology and relate it with its major Divisions?

Ans: Definition of Biology:

Biology is the scientific study of life. The word "biology" has been derived from two Greek words; 'bios' meaning 'life' and 'logos' meaning 'thought or reasoning'.

Relation of biology with its major divisions/Branches:

Divisions and Branches of Biology:

There are three major divisions of biology which study the different aspects of the lives of the major groups of organisms.

Zoology: This division of biology deals with the study of animals.

Botany: This division of biology deals with the study of plants.

Microbiology:

This division of biology deals with the study of microorganisms such as bacteria etc.

(iii) How would you distinguish the biomolecules from other molecules? What is the criterion for classifying a biomolecule as micromolecule or macromolecule?

Ans: An organism is formed by enormous number of biomolecules of hundreds of different types. These molecules are the building material and energy source.

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Micromolecules: Micromolecules are with low molecular weight e.g. glucose, amino acids, fatty acids etc.

Macromolecules: Macromolecules are with high molecular weights e.g. starch, proteins, lipids etc.

Conjugated Molecules:

Two different molecules, belonging to different categories, usually combine together to form conjugated molecules e.g. glycoproteins, lipoproteins, nucleoproteins etc.

(iv) Is there any division of labour among the cells of a colony? If you find division of labour among the cells and tissue what level of cellular organization is it?

Ans: In colonial type of cellular organization, many unicellular organisms live together but do not have any division of labour among them. Each unicellular organism in a colony lives its own life and does not depend on other cells for its vital requirements. Volvox is a green alga found in water that shows colonial organization. Hundreds of Volvox cells make a colony.

OR (Second Answer)

Colonial organization doesn't have any division of labour. Division of labour is at organelle level in unicellular organization. Division of labour is fully developed in multicellular organization. It may be at cellular, tissue, organ and organ system level.

(v) Define science?

Ans: Science:

Science is the study in which observations are made, experiments are done and logical conclusions are drawn in order to understand the principles of nature.

(vi) What Dr. Abdul Salam told about scientific knowledge?

Ans: Scientific Knowledge is the common heritage of mankind. Dr. Abdus Salam.

(vii) Describe the division of living organisms into different groups in biology?

Ans: a. The unicellular organisms that do not have distinct nucleus are grouped as prokaryotes; for example bacteria. The unicellular or simple multicellular organisms with distinct nuclei are called protists e.g. Euglena, Paramecium, Green algae etc.

b. Fungi e.g. mushrooms are multicellular, heterotrophic and absorptive in their mode of nutrition. Plants e.g. mustard are multicellular autotrophic organisms that develop from embryos. Animals e.g. frog are multicellular heterotrophic organisms that ingest food.

(viii) Define Community?

Ans: Community:

Communal life means Interactions within community, while community is defined as organisms of all species living in a particular habitat at a particular time.

SECTION-C (Marks 15)

Q.3 Attempt any FIVE parts from the following. All parts carry equal marks. Be brief and to the point. (5 × 3 = 15)

(i) Which are not the subject of biotechnology?

Ans: The term biotechnology is only used when microorganisms, plants or animals are used to produce something other than food. Therefore, use of farm animals and crops for milk, meat, eggs and cereals is not included in biotechnology.

(ii) Which are the major biological issues today?

Ans: Human population growth, infectious diseases, addictive drugs, and environmental pollution are the major biological issues today.

(iii) Draw a linkage table which describe parameters of study at different levels of biological organization?

Ans: Parameters of study at different levels of biological organization:

Level of Organization	Parameters of Study
Subatomic particles and atom	i) Number of electrons, protons, neutrons in bioelements ii) Arrangements of electrons in shells

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Organelles and Cells	i) Structure and function of organelles ii) Structure of cell iii) Cell cycle
Tissue	i) Type of tissue ii) Role of cells in the function of tissue
Organ and Organ System	i) Structure and function of organ ii) Coordination among different tissues of an organ and among different organs of an organ system
Individual (whole organism)	i) Coordination among organ systems
Population	i) Gene frequency, gene flow, population density, population pressure ii) Effects of abiotic factors
Community	i) Interactions among different species ii) Effects of abiotic factors on different populations

(iv) Describe the structure of an atom?

Ans: Structure of an atom:

Protons and neutrons are located inside nucleus of atom while electrons orbit in energy levels (electron shells) around the nucleus. The number of electrons in the outermost shell determines the manner in which atoms react with each other

Molecule:

A molecule is the smallest part of a compound that retains the properties of that retains the properties of the compounds.

(v) Enlist the vital organs which can be damage by notorious diseases?

Ans: Some notorious diseases damage vital organs for example kidneys liver, lungs etc and lead to death. Kidney of some donor can be transplanted. if the kidney damage has been diagnosed well in time.

(vi) Describe the organelles present in Prokaryotes and Eukaryotes.

Ans: Prokaryotes:

Prokaryotes have only limited number and types of organelles in their cells. They are made up of simple cells which lack membrane bounded organelles e.g. mitochondria, Golgi complex.

Eukaryotes:

Eukaryotes have large number and types of organelles in their cells. They are made up of complex cells which have membrane bounded organelles. A cell membrane (outer covering of cell) is however present in all cells, whether prokaryotic or eukaryotic.

In the case of bacteria and most protists, the entire organism consists of a single cell. In the case of most fungi, animals and plants, the organism consists of up to trillions of cells.

(vii) Describe the Functions of digestive organs and sum up processes of digestive system?

Ans: Functions of digestive organs and sum up processes of digestive system:

Organ	Role of Organ	Process occurring in organ system
Oral cavity	Selection, intake, mastication and grinding of food.	Ingestion
	Partial digestion of polysaccharides	
Stomach	Grinding of food	Digestion
	Melting of lipids	
	Partial digestion of proteins	
Liver	Emulsification of lipids	
Pancreas	Complete digestion of all foods	
Small Intestine	Complete digestion of all foods.	

SECTION-D (Marks 20)

Note: Attempt any TWO questions. All questions carry equal marks. (2 × 10 = 20)

Q.4 Draw a table showing the branches of biology and the studies these deal with?

Ans: In order to study all the aspects of life, these branches are:

Branch of biology	Studies deal with
Morphology	This branch deals with the study of the structures of living organisms.
Molecular biology (biochemistry)	This branch deals with the study of the molecules of life; e.g. water, proteins, carbohydrates, lipids, and nucleic acids. The study of the biochemical reactions occurring in organisms is also included in this branch.
Anatomy	The study of internal structure is called anatomy.
Histology	The microscopic study of tissues is called histology.
Cell biology	The study of the structures and functions of cells and cell organelles is called cell biology. This branch also deals with the study of cell division.
Physiology	This branch deals with the study of the functions of different parts of living organisms.
Genetics	The study of genes and their roles in inheritance is called genetics. Inheritance means the transmission of characters from one generation to the other.
Embryology	It is the study of the development of an embryo to new individual.
Taxonomy	It is the study of the naming and classification of organisms into groups and subgroups.
Palaeontology	It is the study of fossils, which are the remains of extinct organisms.
Environmental biology	It deals with the study of the interactions between the organisms and their environment.
Socio-biology	This branch deals with the study of social behaviour of the animals that make societies.
Parasitology	This branch deals with the study of parasites. Parasites are the organisms that take food and shelter from living hosts and, in return, harm them.
Biotechnology	It deals with the practical application of living organisms to make substances for the welfare of mankind.
Immunology	It is the study of the immune system of animals, which defends the body against invading microbes.
Entomology	It is the study of insects.
Pharmacology	It is the study of drugs and their effects on the systems of human body. Human population growth, infectious diseases, addictive drugs and pollution are the major biological issues today.

Q.5 Describe the levels of organization of life?

Ans: The Levels of Organization:

In order to understand the various phenomena of life, biologists study biological organization at different levels, which are as follows.

1. **Subatomic and Atomic level:**

All types of matter are made up of elements and each element contains a single kind of atoms ('a': not, 'tom': cut). The atoms are actually made up of many subatomic particles.

The most stable subatomic particles are electrons, protons and neutrons.

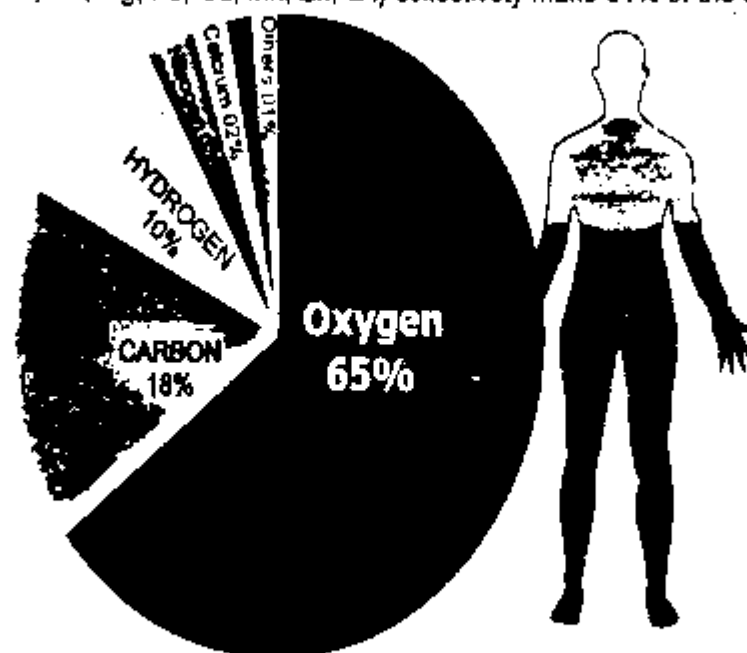
Bioclements:

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Guess Papers

- ♦ Other ten (K, S, Cl, Na, Mg, Fe, Cu, Mn, Zn, & I) collectively make 01% of the total mass.



Percentage composition (by mass) of bioelements in the protoplasm of living organisms

Recalling:

Protons and neutrons are located inside nucleus of atom while electrons orbit in energy levels (electron shells) around the nucleus. The number of electrons in the outermost shell determines the manner in which atoms react with each other.

ii. Molecular level:

In organisms, bioelements usually do not occur in isolated forms rather they combine through ionic or covalent bonding. The stable particle formed by such bonding is called as molecule or biomolecule.

Recalling:

A molecule is the smallest part of a compound that retains the properties of that retains the properties of the compounds.

An organism is formed by enormous number of biomolecules of hundreds of different types. These molecules are the building material and are themselves constructed in great variety and complexity due to specific bonding arrangements. Biomolecules are classified as micromolecules and macromolecules.

Micromolecules are with low molecular weight e.g. glucose, water etc. and **macromolecules** are with high molecular weights e.g. starch, proteins, lipids etc.

iii. Organelle and Cell level:

Biomolecules assemble in a particular way and form organelles. The organelles are actually sub-cellular structures and when they assemble together, units of life i.e. cells are formed.

Each type of organelle is specialized to perform a specific function.

For example; mitochondria are specialized for cellular respiration and ribosomes are specialized for protein synthesis. In this way, functions of the cell are accomplished by these specialized structures. It is an example of the division of labour within the cell.

In the case of prokaryotes and most protists, the entire organism consists of a single cell. In the case of most fungi, all animals and all plants, the organism consists of up to trillions of cells

iv. Tissue level:

In multicellular organisms, similar cells (performing similar functions) are organized into groups, called tissues. We can define a tissue as a group of similar cells specialized for the performance of a common function. Each cell in a tissue carries on its own life processes (like cellular respiration, protein synthesis), but it also carries on some special processes related to the function of the tissue.

There are different types of plant tissues e.g. epidermal tissue, ground tissue, etc. Animal tissues are also of different types e.g. nervous tissue, muscular tissues etc.

For example stomach is an organ specialized for the digestion of proteins and for storing food. Two major types of tissue are present in its structure.

Epithelial (glandular) tissue secretes gastric juice for the digestion of proteins. **Muscular tissue** performs contractions of stomach walls for grinding of food and moving food to posterior end. So two tissues perform their specific functions, which collectively become the function of stomach.

The next level of organization in multicellular organisms is the organ system level. Different organs performing related functions are organized together in the form of an organ system. In an organ system, each organ carries out its specific function and the functions of all organs appear as the function of the organ system.

For example, digestive system is an organ system that carries out the process of digestion. Major organs in its framework are oral cavity, stomach, small intestine, large intestine, liver, and pancreas. All these organs help in the process of digestion.

The organ system level is less complex in plants (e.g. root system) as compared to animals. This is due to a greater range of functions and activities in animals than in plants.

vi. Individual level:

Different organs and organ systems are organized together to form an individual or organism. In organism, the functions, processes and activities of various organs and organ systems are coordinated. For example, when a man is engaged in continuous and hard exercise, not only his muscles are working but also there is an increase in the rate of respiration and heart beat. This accelerated rate of respiration and heart beat supplies more oxygen and food to the muscles which they need for continuous work.

vii. Population Level:

Biologists extend their studies to the population level where they study interactions among member of the same species living in the same habitat. A population is defined as a group of organisms of the same species located at the same place, in the same time. For example, human population in Pakistan in 2010 comprises of 173.5 million individuals (according to the Ministry of Population Welfare, Government of Pakistan).

A species is defined as a group of organisms capable of interbreeding and producing fertile offspring.

Habitat means the area of the environment in which organism lives.

viii. Community level:

A community is an assemblage of different populations, interacting with one another within the same environment. A forest may be considered as a community. It includes different plant, microorganisms, fungi and animal species. Communities are collections of organisms, in which one population may increase and others may decrease.

Complex Communities:

Some communities are complex e.g. a forest community a pond community etc. Other communities may be simple e.g. a fallen log with various populations under it

Simple Community: In a simple community number and size of populations is limited.

So any change in biotic or abiotic factors may have drastic and long lasting effects.

ix. Biosphere level:

The part of the Earth inhabited by organisms' communities is known as biosphere. It constitutes all ecosystems (areas where living organisms interact with the nonliving components of the environment) and is also called the zone of life on Earth.

Q.6 Describe the three ways of cells organization to make the bodies of living organisms?

Ans: Organization of cell:

All the organisms have been divided into five major groups i.e. prokaryotes, protists, fungi, plants and animals. All organisms are made of cells.

Types of cell:

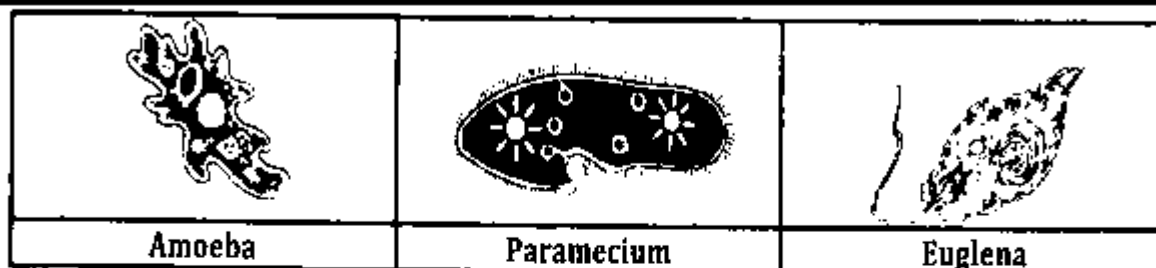
There are two basic types of cells. The organisms in first group are made of prokaryotic cells while all other groups have eukaryotic cells. Cells organize in three ways to make the bodies of organisms.

Cells make unicellular, colonials and multicellular organizations and the organisms formed through these organizations are unicellular organisms, colonial organisms and multicellular organisms.

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Colonial type of cellular organization:

In colonial type of cellular organization, many unicellular organisms live together but do not have any division of labour among them. Each unicellular organism in a colony lives its own life and does not depend on other cells for its vital requirements. Volvox is a green alga found in water that shows colonial organization. Hundreds of Volvox cells make a colony.



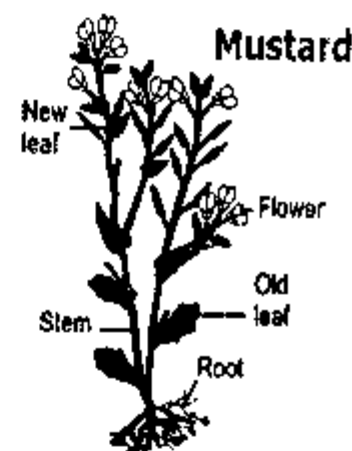
Volvox Colony

Multicellular organization:

In multicellular organization cells are organized in the form of tissues, organs and organ systems. Frog and mustard are the familiar examples of multicellular organization.

Mustard plant:

Mustard plant (scientific name: *Brassica campestris*) is sown in winter and it produces seeds at the end of winter. The plant body is used as vegetable and its seeds are used for extracting oil. The organs of the body can be divided into two groups on the basis of their functions. Root, stem, branches and leaves are the vegetative organs, which do not take part in the sexual reproduction of the plant. Flowers are the reproductive parts of the plant because they take part in sexual reproduction and produce fruits and seeds.



Frog:

Frog (scientific name: *Rana tigrina*) shows the multicellular organization. The body is made of organ systems and each organ system consists of related organs. All the organs are made of specific tissues (epithelial, glandular, muscular, nervous etc).



Chapter # 2

Solving a Biological Problem

Topics Included:

- Biological Method (20-23)
- Theory, Law and Principle (26-27)
- Data Organization And Data Analysis (27-28)

GUESS PAPER & MODEL PAPER # 2 BASED ON CHAPTER # 2 (Reduced Syllabus) SOLVING A BIOLOGICAL PROBLEM

BIOLOGY SSC-I SECTION-A

Time allowed: 20 Minutes

Marks: 12

NOTE:- Section-A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 20 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q.1 Encircle the correct option i.e. A / B / C / D. All parts carry equal marks.

- Which one of the following is a correct sequence in biological method?
 - Observations, Hypothesis, Law, Theory
 - Hypothesis, Observations, Deduction, Experimentation
 - Observations, Hypothesis, Deduction, Experimentation
 - Law, Theory, Deduction, Observations
- Which one of these is NOT a characteristic of a hypothesis?
 - Must be consistent with all available data
 - Must be testable
 - Must be correct
 - Must make predictions
- At which point is a biologist most likely to use reasoning?
 - While taking observations
 - During hypothesis formulation
 - During data organization
 - None of the above
- A hypothesis must be testable to be scientifically valid. Being testable means that _____.
 - Some observation could prove the hypothesis incorrect
 - Only a controlled experiment can indicate whether the hypothesis is correct or incorrect
 - The hypothesis has been proven wrong
 - There must be several options in the hypothesis to choose from, one of which is correct
- What would be the best experimental design for testing a hypothesis that bean plants require sodium?
 - Measure the amount of sodium in a few bean plants
 - Grow bean plants with and without sodium
 - Look for sodium in leaf tissues
 - Analyze root contents for sodium
- A gardener sees a large snake nearby. He knows that generally snakes sting, so the gardener ran away. The gardener did which of the following?

Chapter # 02

Solving a Biological Problem

Guess Papers

- vii. A scientific theory has which of the following properties?
A. It agrees with available evidence
B. It cannot be rejected
C. It has been absolutely proven
D. It does not need to be altered in the light of new evidence
- viii. Experimentation is only a step of the scientific process, but it is a very important step because it always _____.
A. Gives the biologist a correct result
B. Allows rejection of some alternative hypotheses
C. Ensures that hypotheses can be confirmed with certainty
D. Gives scientists a chance to work in the laboratory
- ix. Deductive reasoning;
A. Is always correct
B. Uses specific observations to draw more general conclusions
C. Is not applied in biological method
D. Uses general observations to predict specific conclusions
- x. You are testing a hypothesis; "students learn more if a They drink tea before sitting for study". Your 20 experimental students drink tea before study; you test their learning by giving questions. Your 20 students of the control group should have all experimental conditions identical to the experimental group EXCEPT that;
A. They should take tea with more milk and sugar
B. They should take tea before as well as during study
C. They should not take tea before studying
D. They should not sit for studying
- xi. A common species of mosquito; bites mammals:
A. Culex B. Anopheles C. Plasmodium D. Cinchona
- xii. Unicellular organism that causes malaria in mammals and birds etc.
A. Plasmodium B. Culex C. Anopheles D. Cinchona

BIOLOGY SSC-I

Time allowed: 2:40 Hours

Total Marks: 53

NOTE: Answer any six parts from Section 'B' and attempt any five parts from Section-C. Attempt any two questions from Section 'D' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

SECTION-B (Marks 18)

- Q.2 Attempt any SIX parts from the following. All parts carry equal marks. Be brief and to the point. (6 × 3 = 18)
- (i) How the principles of ratio and proportion are used in biological method.
 - (ii) Define Science.
 - (iii) "Man has always been a biologist". Justify the statement.
 - (iv) What is biological method. Give its significance also.
 - (v) What is "Control" in experiments?
 - (vi) What is the observations of Darwin?
 - (vii) Let's consider a hypothesis: "All plant cells have a nucleus". Write the deduction make by the biologists about this hypothesis?
 - (viii) Differentiate between theory and law.

SECTION-C (Marks 15)

Chapter # 02

Solving a Biological Problem

Guess Papers

- (ii) If a test shows that some people have *Plasmodium* in their blood but they do not show any symptoms of malaria, what? Hypothesis would you formulate to answer this problem?
- (iii) Justify mathematics as an integral part of the scientific process.
- (iv) Write down the steps for solving a biological problem.
- (v) Write three characteristics of hypothesis.
- (vi) Define Data?
- (vii) Differentiate between Biological method and Biological problem?

SECTION-D (Marks 20)

- Note: Attempt any TWO questions. All questions carry equal marks. (2 × 10 = 20)
- Q.4 Briefly describe data organization and data analysis are important steps in the biological method.
- Q.5 Describe the steps involved in solving a biological problem by biologist?
- Q.6 How theory, law and principle are formulated?

SOLUTION OF GUESS PAPER & MODEL PAPER # 2 (Reduced Syllabus)

SECTION- A (MCQs)

i. C	ii. C	iii. B	iv. C	v. B	vi. B
vii. C	viii. B	ix. D	x. C	xi. B	xii. A

SECTION-B (Marks 18)

Time allowed: 2:40 Hours

Total Marks: 53

NOTE: Answer any six parts from Section 'B' and attempt any five parts from Section-C. Attempt any two questions from Section 'D' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

- Q.2 Attempt any SIX parts from the following. All parts carry equal marks. Be brief and to the point. (6 × 3 = 18)

- (i) How the principles of ratio and proportion are used in biological method.

Ans: Data analysis:

Data analysis is necessary to prove or disprove a hypothesis by experimentation. It is done through the application of statistical methods i.e. ratio and proportion

Ratio:

When a relation between two numbers e.g. 'a' and 'b' is expressed in terms of quotient (a/b), it is called the ratio of one number to the other. Ratio may be expressed by putting a division (+) or colon (:) mark between the two numbers. For example the ratio between 50 malarial patients and 150 normal persons is 1:3.

Proportion:

Proportion means to join two equal ratios by the sign of equality (=). For example; $a:b = c:d$ is a proportion between the two ratios. This proportion may also be expressed as $a:b::c:d$. When three values in a proportion are known, the fourth one (x) can be calculated

For example, a biologist can calculate how many birds will get malaria when he allows infected mosquitoes to bite 100 healthy sparrows. If in a previous experiment 14 out of 20 got malaria.

1st Ratio 14:20 (14 out of 20)

2nd Ratio X:100 (How many out of 100)

— Proportion 14 : 20 :: X : 100

It means 70 out of 100 sparrows get malaria.

Importance of statistics:

Statistics are thus a means of summarizing data through the calculation of mean value. This step is very important as it transforms raw data into information, which can be used to summarize and report results.

(ii) Define Science.

Ans: Science: Science is the systemized knowledge derived from observations and experiments.

These experiments are carried out to determine the principles about how nature operates. Scientists like chemists, biologists and physicists use the same scientific method to make and test new theories.

(iii) "Man has always been a biologist". Justify the statement.

Ans: Man has always been a biologist. He had to be a biologist in order to live. Early in history, he was a hunter of animals and a gatherer of fruits, seeds, roots etc.

The more he knew about animals and their habitat, the more successful hunter he was. The more he knew about plants, the better he distinguished between edible from non-edible plants.

(iv) What is biological method. Give its significance also.

Ans: Biological Method:

The scientific method in which biological problems are solved, is termed as biological method. It comprises the steps a biologist adopts in order to solve biological problem.

Significance of biological method:

The biological method has played an instrumental part in scientific research for almost 500 years. From Galileo's experiment back in the 1590s to current research, the biological method has contributed to the creation of vaccines and advancements in medicine and technology. The biological method also ensures the quality of data for public use.

(v) What is "Control" in experiments?

Ans: "Control" in experiments:

In science when doing the experiment, it must be a controlled experiment. The scientist must contrast an "experimental group" with a "control group". The two groups are treated exactly alike except for the one variable being tested. For example, in an experiment to test the necessity of carbon dioxide for photosynthesis, one can contrast the control group (a plant with freely available carbon dioxide) with an experimental group (a plant with no carbon dioxide available). The necessity of carbon dioxide will be proved when photosynthesis occurs in the control group and does not occur in the experimental group.

(vi) What is the observations of Darwin?

Ans: Observations of Darwin:

Ans: Darwin not only observed and took notes during his voyage, but he also read the works of other naturalists to form his theory of Evolution.

(vii) Let's consider a hypothesis: "All plant cells have a nucleus". Write the deduction make by the biologists about this hypothesis?

Ans: Biologist can't usually check every situation where a hypothesis might apply. Let's consider a hypothesis: "All plant cells have a nucleus". Biologist cannot examine every living plant and every plant that has ever lived to see if this hypothesis is false. Instead, biologists generate deduction using reasoning. From the above hypothesis, a biologist can make the following deduction: "If I examine cells from a blade of grass, then each one will have a nucleus".

(viii) Differentiate between theory and law.

Ans: Theory:

When a hypothesis is given a repeated exposure to experimentation and is not falsified, then it is called theory.

When a hypothesis has been proved by consistent results it becomes a theory. The hypotheses that stand the test of time (often tested and never rejected), are called theories. A theory is supported by a great deal of evidence.

SECTION-C (Marks 15)

Q.3 Attempt any FIVE parts from the following. All parts carry equal marks. Be brief and to the point. (5 × 3 = 15)

(i) Quantitative observations are better in biological method. How?

Ans: Quantitative observations:

Quantitative observations are considered more accurate than qualitative ones because the former are invariable and measurable and can be recorded in terms of numbers. Examples of qualitative and quantitative observations are given below.

No.	Qualitative observations	Quantitative observations
i.	The freezing point of water is colder than the boiling point.	The freezing point of water is 0°C and the boiling point is 100°C.
ii.	A liter of water is heavier than a liter of ethanol.	A liter of water weighs 1000 grams and a liter of ethanol weighs 789 grams.

(ii) If a test shows that some people have *Plasmodium* in their blood but they do not show any symptoms of malaria, what? Hypothesis would you formulate to answer this problem?

Ans: Hypothesis:

If some people have *Plasmodium* in their blood but they do not show any symptoms of malaria, then *plasmodium* is present in them in incubation period.

OR (Second Answer)

If a test shows that some people have *Plasmodium* in their blood but they do not show any symptoms of malaria, then the hypothesis is as follows.

"The *plasmodium* are in a period of incubation. They will take time to spread in the whole body".

(iii) Justify mathematics as an integral part of the scientific process.

Ans: Mathematics as an integral part of scientific process:

Biological method also involves the use of applied mathematics to solve biological problems. Major biological problems in which knowledge of mathematics is used include gene finding, protein structure, and protein-protein interactions etc.

Bioinformatics:

Bioinformatics refers to the computational and statistical techniques for the analysis of biological data.

(iv) Write down the steps for solving a biological problem.

Ans: In solving a biological problem, biologist takes following steps;

1. Recognition of biological problem
2. Observations
3. Hypothesis formulation
4. Deductions
5. Experimentation
6. Summarization of results (create tables, graphics etc)
7. Reporting the results

(v) Write three characteristics of hypothesis.

Ans: Characteristics of Hypothesis:

A hypothesis should have the following characteristics

1. It should be a general statement.
2. It should be a tentative idea.
3. It should agree with available observations.
4. It should be kept as simple as possible
5. It should be testable and potentially falsifiable. In other words, there should be a way to show the hypothesis is false; a way to disprove the hypothesis

(vi) Define Data?

(vii) Differentiate between Biological method and Biological problem?

Ans: **Biological method:**

The scientific method in which biological problems are solved; comprises the steps a biologist adopts in order to solve a biological problem.

Biological problem:

A query about life that is either asked by someone or comes in biologist's mind by himself.

SECTION-D (Marks 20)

Note: Attempt any TWO questions. All questions carry equal marks.

(2 × 10 = 20)

Q.4 Briefly describe data organization and data analysis are important steps in the biological method.

Ans: **Data organization:**

1. In order to formulate and then to test the hypotheses scientists collect and organize data. Through the use of variables and controls, results can be determined. Variables are those factors being tested in an experiment and are usually compared to a control. A control is a known measure to which scientists can compare their results.
2. Prior to conducting an experiment it is very important for a scientist to describe the data collection methods. It ensures the quality of the experiment. Attention must be paid to ensure that data collection methods are kept balanced.
3. Data is organized in different formats like graphics, tables, flow charts, maps and diagrams.

Data analysis:

Data analysis is necessary to prove or disprove a hypothesis by experimentation. The methods involved in testing/analyzing the data are also important since an experiment should be repeated by others to ensure the quality of results. Depending on the type of data and the biological problem, this might include application of statistical methods i.e. ratio and proportion. When a relation between two numbers e.g. 'a' and 'b' is expressed in terms of quotient (a/b), such a relation is the ratio of one number to the other. A ratio may be expressed by putting a division (+) or colon (:) mark between the two numbers. For example the ratio between 50 malarial patients and 150 normal persons is 1:3

Q.5 Describe the steps involved in solving a biological problem by biologist?

Ans: **Solving of Biological Problem:**

Biological Problem, Hypothesis, Deductions and Experiments:

In biology (like other sciences), new things are being discovered and long-held theories are being modified or replaced with better ones as more data/knowledge is accumulated. This happens when biologists recognize some biological problem and go for its solution.

In solving a biological problem, biologist takes following steps;

1. Recognition of biological problem
2. Observations
3. Hypothesis formulation
4. Deductions
5. Experimentation
6. Summarization of results (create tables, graphics etc)
7. Reporting the results

The details of these steps are as under:

1. Recognition of the biological problem:

Biologists go for adopting biological method when they encounter some biological problem. A biological problem is a query about life that is either asked by someone or comes in biologist's mind by himself.

2. Observations:

As the first step in solving a biological problem, the biologist recalls his/her previous observations or makes new ones. Observations are made with five senses of vision, hearing, smell, taste and touch.

terms of numbers.

Examples of qualitative and quantitative observations are given below.

Qualitative Observations	Quantitative Observations
1. The freezing point of water is colder than the boiling point.	1. The freezing point of water is 0 °C and the boiling point is 100 °C.
2. A liter of water is heavier than a liter of ethanol.	2. A liter of water weighs 1000 grams and a liter of ethanol weighs 789 grams.

Note: Observations also include reading and studying what others have done in the past because scientific knowledge is ever – growing.

3. Formulation of Hypothesis:

Observations do not become scientific observations until they are organized and related to a question. Biologist organizes his/her and others' observations into data form and constructs a statement that may prove to be the answer of the biological problem under study. This tentative explanation of observations is called a hypothesis. It may be defined as a proposition that might be true.

Characteristics of Hypothesis:

A hypothesis should have the following characteristics:

1. It should be a general statement.
2. It should be a tentative idea.
3. It should agree with available observations.
4. It should be kept as simple as possible.
5. It should be testable and potentially falsifiable. In other words, there should be a way to show the hypothesis is false; a way to disprove the hypothesis.

Conditions for Hypothesis:

A great deal of careful and creative thinking is necessary for the construction of a hypothesis. Biologists use reasoning to formulate a hypothesis.

4. Deductions:

In the next step, biologist draws deductions from hypotheses. Deductions are the logical consequences of hypotheses. For this purpose, a hypothesis is taken as true and expected results (deductions) are drawn from it.

Generally in biological method, if a particular hypothesis is true then one should expect (deduction) a certain result. This involves the use of "if-then" logic.

5. Experimentation:

The most basic step of biological method is experimentation. Biologist performs experiments to see if hypotheses are true or not. The deductions, which are drawn from hypotheses, are subjected to rigorous testing. Through experimentations, biologist learns which hypothesis is correct.

The incorrect hypotheses are rejected and the one which proves correct is accepted. An accepted hypothesis makes further predictions that provide an important way to further test its validity.

6. Summarization of results:

The biologist gathers actual, quantitative data from the experiments. Data for each of the groups are then averaged and compared statistically. To draw conclusions, the biologist also uses statistical analysis.

7. Reporting the results:

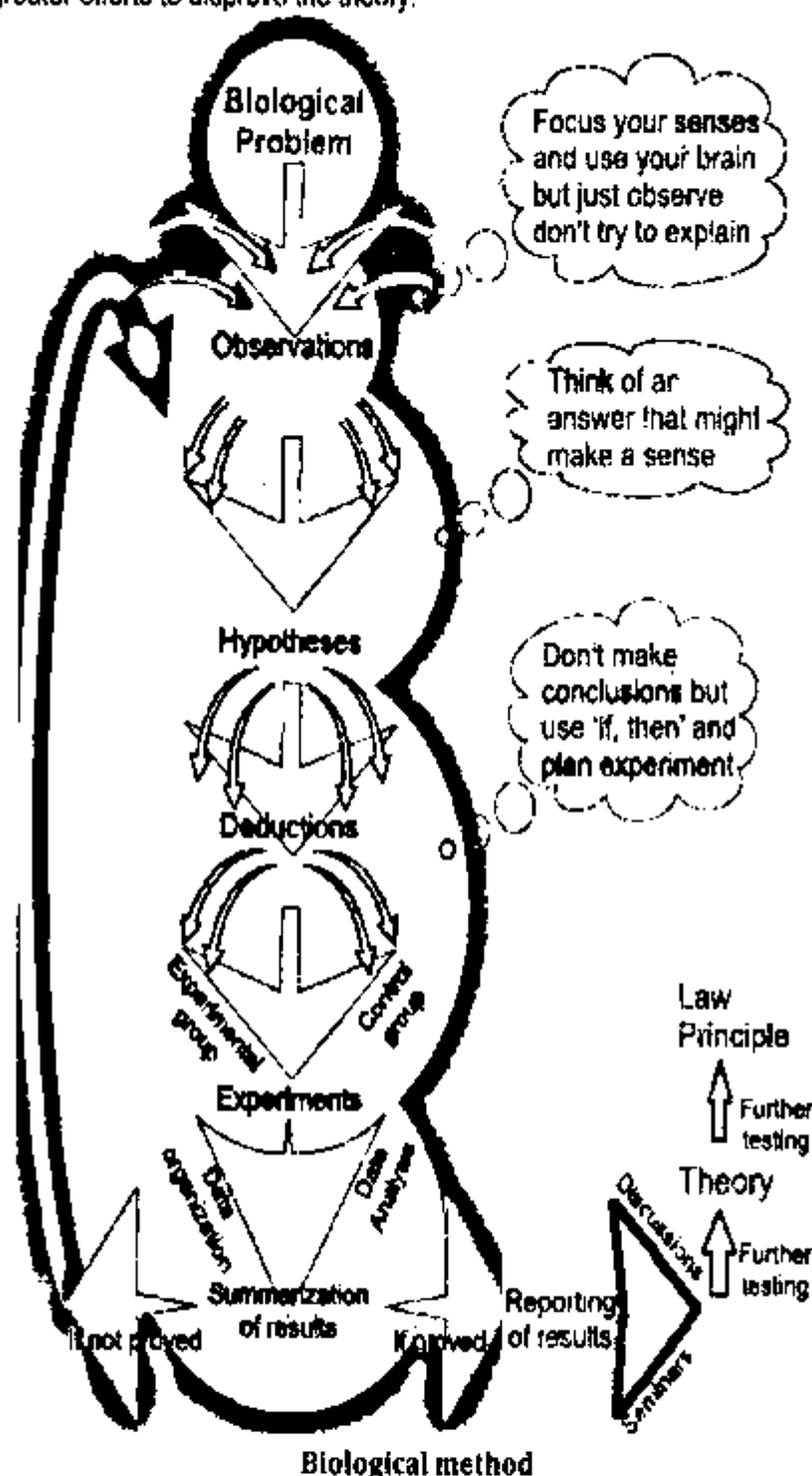
Biologists publish their findings in scientific journals and books, in talks at national and international meetings and in seminars at colleges and universities. Publishing of results is an essential part of the scientific method. It allows other people to verify the results or apply the knowledge to solve other problems.

Q.6 How theory, law and principle are formulated?

Ans: Theory, law and principle:

When a hypothesis is given a repeated exposure to experimentation and is not falsified, it increases biologists' confidence in hypothesis. Such well-supported hypothesis may be used as the basis for formulating further hypotheses which are again proved by experimental results.

Productive theory keeps on suggesting new hypotheses and so testing goes on. Many biologists take it as a challenge and exert greater efforts to disprove the theory.



Law and Principle:

If a theory survives such doubtful approach and continues to be supported by experimental evidence, it becomes a law or principle. A scientific law is a uniform or constant fact of nature. It is an irrefutable theory. The examples of biological laws are Hardy-Weinberg law and Mendel's Laws of inheritance.

Chapter # 3

Biodiversity

Topics Included:

- Biodiversity (31)
- Importance of Biodiversity (32)
- Classification- Aims and Principles (33-35)
- Aims of classification
- Basis of classification
- Taxonomic hierarchy
- Two kingdom classification system (36-38)
- Three kingdom classification system
- Five kingdom classification System
- The five kingdoms Binomial Nomenclature (39-40)
- Deforestation and Overhunting (43-44)
- Endangered Species In Pakistan (45-46)

GUESS PAPER & MODEL PAPER # 3 BASED ON CHAPTER # 3 (Reduced Syllabus) BIODIVERSITY

BIOLOGY SSC-I SECTION-A

Time allowed: 20 Minutes

Marks: 12

NOTE:- Section-A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 20 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q.1 Encircle the correct option i.e. A / B / C / D. All parts carry equal marks.

- Classification means the grouping of organisms on the basis of;
A. How they feed
B. The features they have in common
C. How they respire
D. How they can survive
- The kingdom Protista includes;
A. Unicellular and simple multicellular organisms with membrane bounded nucleus
B. True multicellular organisms with no distinct membrane bounded nucleus
C. True multicellular organisms with membrane bounded nucleus
D. Unicellular organisms with no distinct membrane bounded nucleus
- Viruses are not classified in any kingdom because;
A. They are too poorly understood
B. They are too small
C. Their genetics cannot be determined
D. They are not considered organisms
- Viruses are assigned to the kingdom;
A. Monera
B. Protista
C. Fungi
D. None
- A related group of genera comprises;
A. An order
B. A family
C. Class
D. A phylum

Chapter # 03

Biodiversity

Guess Papers

- vii. In binomial nomenclature, the first letter of the name _____ is capitalized.
A. Family B. Class C. Species D. Genus
- viii. Which one of the following sequences shows the correct hierarchy of classification, going from the smaller to the bigger group?
A. Kingdom, Phylum, Order, Class, Family, Genus, Species
B. Kingdom, Phylum, Class, Order, Family, Genus, Species
C. Genus, Species, Kingdom, Phylum, Order, Class, Family
D. Species, Genus, Family, Class, Order, Phylum, Kingdom
- ix. Which of the following may be the correct way of writing the scientific name of an organism?
A. Canis lupis B. Saccharum C. Grant's gazelle D. E. Coli
- x. A certain organism is multicellular, adapted for photosynthesis, and has multicellular sex organs. To which kingdom does it belong?
A. Animalia B. Fungi C. Plantae D. Protista
- xi. Species that are in the same are more closely related than species that are in the same
A. Phylum ... class B. Family ... order C. Class ... order D. Family...genus
- xii. When the last member of a particular species dies, the species is said to be _____.
A. Established B. Extinct C. Threatened D. Endangered

BIOLOGY SSC-I

Time allowed: 2:40 Hours

Total Marks: 53

NOTE: Answer any six parts from Section 'B' and attempt any five parts from Section-C. Attempt any two questions from Section 'D' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

SECTION-B (Marks 18)

- Q.2 Attempt any SIX parts from the following. All parts carry equal marks. Be brief and to the point. (6 × 3 = 18)
- What is the difference between the modes of nutrition of fungi and animals?
 - It is difficult to use the criterion of interbreeding to define species of unicellular organisms. Why?
 - How are taxonomy and systematic related?
 - Differentiate between the terms "extinct" and "endangered".
 - What are the contributions of Whittaker, Margulis and Schwartz in taxonomy?
 - Describe the three kingdoms and five ranks used by Carolus Linnaeus?
 - Define Species?
 - How can you divide the five kingdoms into two groups on the basis of types of cells?

SECTION-C (Marks 15)

- Q.3 Attempt any FIVE parts from the following. All parts carry equal marks. Be brief and to the point. (5 × 3 = 15).
- Who suggested the terms of, "Procariotique" and "Eucariotique"?
 - Describe the functions of Prions and Viroids?
 - Why the Orchid tree (Mountain-ebony) was named as Bauhinia variegata?
 - How many kinds of organisms inhabit the earth?

SECTION-D (Marks 20)

Note: Attempt any TWO questions. All questions carry equal marks. (2 × 10 = 20)

- Q.4 (a) Relate the importance of biodiversity with natural ecosystem through examples?
(b) Explain the aims and principles of classification, keeping in view its historical background?
- Q.5 Describe the aims and principles of binomial nomenclature?
- Q.6 (a) Describe some of the programs running in Pakistan for the conservation of biodiversity?
(b) Describe the general characteristics of the five kingdoms?

SOLUTION OF GUESS PAPER & MODEL PAPER # 3 (Reduced Syllabus)

SECTION- A (MCQs)

i. B	ii. A	iii. D	iv. D	v. B	vi. C
vii. D	viii. D	ix. A	x. C	xi. B	xii. B

SECTION-B (Marks 18)

Time allowed: 2:40 Hours

Total Marks: 53

NOTE: Answer any six parts from Section 'B' and attempt any five parts from Section-C. Attempt any two questions from Section 'D' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

- Q.2 Attempt any SIX parts from the following. All parts carry equal marks. Be brief and to the point. (6 × 3 = 18)

i. What is the difference between the modes of nutrition of fungi and animals?

Ans: Kingdom fungi:

It includes eukaryotic multicellular heterotrophs which are absorptive in their nutritional mode e.g. mushrooms. Most fungi are decomposers. They live on organic material, secrete digestive enzymes and absorb small organic molecules formed by the digestion by enzymes.

Kingdom animalia:

It includes eukaryotic multicellular consumers. Animals live mostly by ingesting food and digesting it within specialized cavities. They lack cell wall and show movements.

Note: Biologists believe that kingdom protista evolved from monera and then it gave rise to the other 3 eukaryotic kingdoms i.e. fungi, plantae and animalia

ii. It is difficult to use the criterion of interbreeding to define species of unicellular organisms. Why?

Ans: The criteria of interbreeding cannot be used for species recognition in organisms who reproduce asexually and do not interbreed with one another (for example many unicellular organisms).

iii. How are taxonomy and systematic related?

Ans: Taxonomy:

The branch of biology which deals with classification is called taxonomy.

Systematic:

The branch which deals with classification and also traces the evolutionary history of organisms is known as systematic.

Relation between taxonomy and systematic:

iv. Differentiate between the terms "extinct" and "endangered".

Ans: Difference between the terms "extinct" and "endangered":

Endangered Species	Extinct Species
Endangered Species are ones that have a very small population and that population is at a greater risk of becoming extinct. Many species that become extinct never make to the endangered species list.	Extinct Species are ones that are either known (documented) to be extinct or are so few in population that a recovery is considered highly unlikely even under excellent conditions.

v. What are the contributions of Whittaker, Margulis and Schwartz in taxonomy?

Ans: **Robert Whittaker:** In 1967, Robert Whittaker introduced the five-kingdom classification system.

Margulis and Schwartz:

In 1988, Margulis and Schwartz modified the five-kingdom classification of Whittaker. They considered genetics along with cellular organization and mode of nutrition in classification. They classified the organisms into the same five kingdoms as proposed by Whittaker.

vi. Describe the three kingdoms and five ranks used by Carolus Linnaeus?

Ans: Carolus Linnaeus (1707-1778) divided the nature into three kingdoms: mineral, vegetable and animal. Linnaeus used five ranks: class, order, genus, species, and variety. Linnaeus is best known for his introduction of the method still used to formulate the scientific name of every species.

vii. Define Species?

Ans: **Species -The Basic Unit of Classification:**

Species is the basic unit of classification.

"A species is a group of organisms which can interbreed freely among them and produce fertile offspring, but are reproductively isolated from all other such groups in nature." Each species possesses its own distinct structural, ecological and behavioural characteristics.

In the definition of species we must emphasize "in nature" because two organisms related to two different but closely related species can cross-breed under artificial conditions. In such unnatural crosses they produce infertile offspring. For example, a cross between a male donkey and a female horse produces an infertile offspring i.e. mule.

viii. How can you divide the five kingdoms into two groups on the basis of types of cells?

Ans: a) Kingdom monera includes organisms with prokaryotic cells.

b) Kingdoms protista, fungi, plantae and animalia includes organisms with eukaryotic cells.

SECTION-C (Marks 15)

Q.3 Attempt any FIVE parts from the following. All parts carry equal marks. Be brief and to the point. (5 × 3 = 15)

i. Who suggested the terms of, "Procariotique" and "Eucariotique"?

Ans: In 1937, E-Chatton suggested the terms of, "Procariotique" to describe bacteria and "Eucariotique" to describe animal and plant cells.

ii. Describe the functions of Prions and Viroids?

Ans: **Prions:** Prions are composed of protein only and act as infectious particles in plants.

Viroids:

Viroids are composed of circular RNA only and act as infectious particles and cause diseases in certain plants.

iii. Why the Orchid tree (Mountain-ebony) was named as *Bauhinia variegata*?

Ans: Sometime organisms are named in honor of the research workers who described and classified them. For example the Orchid tree (Mountain-ebony) was named as *Bauhinia variegata* after the Swiss botanists Bauhin. *Bauhinia variegata* is an ornamental tree found in southeastern Asia.

iv. How many kinds of organisms inhabit the earth?

v. What is meant by deforestation?

Ans: Deforestation:

Deforestation means cutting down of trees for the conversion of a forest to non-forest land. It is done for using the land for various purposes such as pasture, urban use etc. The destruction of significant areas of forest has resulted in a degraded environment with reduced biodiversity.

vi. Briefly describe endangered species in Pakistan?

Ans: Endangered Species in Pakistan:

Due to human activities, the biodiversity in Pakistan is facing a great loss. Here are a few examples of endangered species in Pakistan.

a. Indus Dolphin:

According to WWF-P, only 600 animals of the species of Indus dolphin are left today in the Indus River. The population of this species declined due to water pollution, poaching, and destruction of habitat.

b. Marco Polo sheep:

Marco Polo sheep are mostly found in the Khunjerab National Park and nearby areas. Their numbers have been rapidly decreasing in the last two decades and WWF-P has started projects for its conservation.

c. Houbara bustard:

This bird flies to Pakistan in winter season from former Soviet territory and settles in Cholistan and Thar deserts. The decline in its population is due to hunting by foreigners and destruction of its habitats.

vii. What is the cause of extinction of species in Pakistan?

Ans: Over-hunting:

Over-hunting has been a significant cause of the extinction of hundreds of species and the endangerment of many more such as whales, ibex, urial, markhor (the national animal of Pakistan) etc. Commercial hunting, both legal and illegal, is the principal threat.

SECTION-D (Marks 20)

Note: Attempt any TWO questions. All questions carry equal marks. (2 × 10 = 20)

Q.4 (a) Relate the importance of biodiversity with natural ecosystem through examples?

Ans: See Q4(a). FBISE Paper (2015), Page # 108.

(b) Explain the aims and principles of classification, keeping in view its historical background?

Ans: Classification - Aims and Principles:

There is a large collection of very dissimilar forms of organisms, found on Earth. Over 1.5 million types of animals and over 0.5 million types of plants are known to biologists and these are only a small percentage of the total types estimated to live on Earth. They range in complexity from small and simple bacteria to large and complex human beings.

Some of them live in sea, some on land; some walk, others fly, and still others are stationary. Each has its own way of life i.e. getting food, avoiding unfavourable environmental conditions, finding a place to live, and reproducing its kind. When there are so many diverse kinds of organisms, it becomes difficult to learn about the characteristics of each.

To study such a large collection, biologists classify the organisms into groups and subgroups and for this task they require some system. Biological classification is a method by which biologists divide organisms into groups and subgroups.

Aims of Classification:

The branch of biology which deals with classification is called taxonomy and the branch which deals with classification and also traces the evolutionary history of organisms is known as systematics.

The main aims of both these branches are:

- ◆ To determine similarities and differences among organisms so that they can be studied easily.
- ◆ To find the evolutionary relationships among organisms

For example sparrows are more closely related to pigeons than to insects. It means that the former two have common evolutionary histories.

When biologists classify organisms into groups and subgroups, the similarities are seen in external and internal structures and stages of development. Modern genetics provides another type of information to taxonomists. The similarities and differences in the DNA of two studied organisms can be used for getting idea about similarities and differences in their structures and functions.

Q.5 Describe the aims and principles of binomial nomenclature?

Ans: Binomial nomenclature:

Binomial nomenclature is the method of giving scientific names to living organisms. As the word "binomial" suggests, the scientific name of a species consists of two names: the first is genus name and the second one is the name of species. Swedish biologist Carolus Linnaeus (1707-1778 AD) first introduced and adopted the system of binomial nomenclature. His system spread rapidly and became popular. Many of his names are in use today.

Some of the rules which are universally adopted while suggesting and documenting scientific names, are:

Principles of binomial nomenclature:

- i. Scientific names are usually printed in italics, such as *Homo sapiens*. When handwritten they are underlined.
- ii. The first term (generic name) always begins with capital letter, while the species name is never capitalized (even when derived from a proper name).
- iii. The scientific name is generally written in full when it is first used. But when several species from the same genus are being listed, it may then be abbreviated by just using an initial for genus; for example *Escherichia coli* becomes *E. coli*.

Sometime organisms are named in honor of the research workers who described and classified them. For example; the Orchid tree (Mountain-ebony) was named as *Bauhinia variegata* after the Swiss botanists Bauhin. *Bauhinia variegata* is an ornamental tree found in southeast Asia.

Significance:

In biological research, common names cause many problems. Different regions have different names for the same organism.

For example; common name of onion in Urdu is 'Piyaz' but in different regions of Pakistan it is also known as 'ganda' or 'bassal' or 'vassal'. In other countries, it has other sets of names. In science, it is known with a single name as *Allium cepa*.

In some cases, different organisms are called by the same common name.

For example; the name 'black bird' is used for crow as well as for raven.

Common names have no scientific basis.

For example; a fish is a vertebrate animal with fins and gills. But several common names of 'silver fish', 'cray fish', 'jelly fish', and 'star fish' do not fit the biologist's definition of a fish.

To avoid all these confusions, organisms are given scientific names by using binomial nomenclature. The value of this system is due to its widespread use and the stability of its names. In binomial nomenclature, every species can be unambiguously identified with just two words. Same name can be used all over the world, in all languages, avoiding difficulties of translation.

Common Name	Scientific Name
Onion	<i>Allium cepa</i>
Amaltas	<i>Cassia fistula</i>
Potato	<i>Solanum tuberosum</i>
Tomato	<i>Lycopersicum esculentum</i>
Man	<i>Homo sapiens</i>

Q.6 (a) Describe some of the programs running in Pakistan for the conservation of biodiversity?

Ans: Following are a few examples of environmental work that has been carried out in Pakistan in order to conserve species and the associated habitats.

i. National Conservation Strategy:

In 1980's the IUCN and the government of Pakistan formulated the National Conservation Strategy for Pakistan for the conservation of Pakistan's biodiversity.

ii. UN Convention on Combating Desertification (CCD):

This is an international treaty against damage and poverty in dry lands. Pakistan signed this in 1997.

iii. Himalayan Jungle Project (HJP):

It started in 1991 in the Palas Valley, in NWFP. It aimed at protecting one of the richest areas of biodiversity in Pakistan.

iv. Conservation of biodiversity of the Suleiman Range, Balochistan:

The Suleiman Range Chilghoza Forest is the largest Chilghoza forest in the world. In 1992 the WWF-P started its conservation program.

v. Northern Areas Conservation Project:

The northern areas of Pakistan serve as a habitat for a number of wildlife species. The survival of these species is under threat. The NACP is a project of WWF-P which is successful in implementing a ban on the hunting of these species.

vi. Conservation of migratory birds in Chitral, KP(Khyber-Pakhtunkhwa):

Chitral lies on the migratory route of several important bird species. These birds face enormous hunting pressure. WWF-Pakistan initiated efforts to reduce the hunting pressure in 1992. The efforts proved successful.

vii. Conservation of Chiltan Markhor:

Hazarganji National Park is located close to Quetta and is the only remaining habitat of Chiltan Markhor in the country. WWF-Pakistan developed the management plan of the park.

viii. Ban on games:

Foreigners visit the northern areas and play many games in which bears are used. WWFPakistan has been successful in imposing a ban on this illegal practice.

(b) Describe the general characteristics of the five kingdoms?

Ans: See Q3(a). FBISE Paper (2016), Page # 113.

Chapter # 4

Cells and Tissues

Topics Included:

- Cellular Structures and Function (57-65)
- Difference Between Eukaryotic and Prokaryotic Cells (66)
- Passage of Molecules into and Out of Cells Diffusion (69)
- Osmosis (70) (Water Balance Problems, Osmosis and Guard Cells, Application of Knowledge About Semi Permeable Membranes Excluded)
- Active Transport (73)
- Animal Tissues (74)
- Epithelial Tissues (Types Excluded) (75)
- Connective Tissues (75)
- Muscle Tissues (76-77)
- Nervous Tissue (77)
- Plant Tissues (78-82)
- Simple Tissues
- Meristematic Tissues (Types Excluded)
- Permanent Tissues (Names of Types Only)
- Compound Tissues (Names of Types Only)

GUESS PAPER & MODEL PAPER # 4 BASED ON CHAPTER # 4 (Reduced Syllabus) CELLS AND TISSUES

BIOLOGY SSC-I SECTION-A

Time allowed: 20 Minutes

Marks: 12

NOTE:- Section-A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 20 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q.1 Encircle the correct option i.e. A / B / C / D. All parts carry equal marks.

i. Which of these clues would tell you whether a cell is prokaryotic or eukaryotic?

- A. The presence or absence of a cell wall
- B. Whether or not the cell is partitioned by internal membranes
- C. The presence or absence of ribosomes
- D. Whether or not the cell contains DNA

ii. There are _____ micrometers (μm) in one millimeter (mm).

- A. 10
- B. 100
- C. 1000
- D. 1/1000

iii. The plasma membrane does all of these except _____.

- A. Contains the hereditary material
- B. Acts as a boundary or border for the cytoplasm
- C. Regulates passage of material in and out of the cell
- D. Functions in the recognition of self

Chapter # 04

Cells and Tissues

Guess Papers

- v. Cells walls are found in these organisms, except for which all lack cell walls?
A. Plants B. Animals C. Bacteria D. Fungi
- vi. The _____ is a major component of plant cell walls.
A. Chitin B. Peptidoglycan C. Cellulose D. Cholesterol
- vii. Plant cells have _____ and _____ which are not present in animal cells.
A. Mitochondria, chloroplasts B. Cell membranes, cell walls
C. Chloroplasts, nucleus D. Chloroplasts, cell wall
- viii. The _____ is the membrane enclosed structure in eukaryotic cells that contains the DNA of the cell.
A. Mitochondrion B. Chloroplast C. Nucleolus D. Nucleus
- ix. Ribosomes are constructed in the _____.
A. Endoplasmic reticulum B. Nucleoid
C. Nucleolus D. Nuclear pore
- x. Rough endoplasmic reticulum is the area in a cell where _____ are synthesized.
A. Polysaccharides B. Proteins C. Lipids D. DNA
- xi. Smooth endoplasmic reticulum is the area in a cell where _____ are synthesized:
A. Polysaccharides B. Proteins C. Lipids D. DNA
- xii. The mitochondrion functions in _____.
A. Lipid storage B. Protein synthesis
C. Photosynthesis D. Cellular respiration

BIOLOGY SSC-I

Time allowed: 2:40 Hours

Total Marks: 53

NOTE: Answer any six parts from Section 'B' and attempt any five parts from Section-C. Attempt any two questions from Section 'D' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

SECTION-B (Marks 18)

- Q.2 Attempt any SIX parts from the following. All parts carry equal marks. Be brief and to the point. (6 × 3 = 18)
- Define active transport. Also describe its function.
 - What are the functions of leucoplasts and chromoplasts?
 - Describe the structure and function of Cytoskeleton?
 - Explain the functions of cell membrane?
 - Describe the structure of cell wall?
 - Differentiate between diffusion and facilitated diffusion?
 - Discuss nucleus structure and function?
 - Describe the formation and function of lysosomes?

SECTION-C (Marks 15)

- Q.3 Attempt any FIVE parts from the following. All parts carry equal marks. Be brief and to the point. (5 × 3 = 15)
- Describe the internal structure of chloroplast and compare it with that of mitochondrion?
 - Explain the phenomena involved in the passage of matter across cell membrane?
 - Describe how turgor pressure develops in a plant cell?
 - Describe the differences in prokaryotic and eukaryotic cells?
 - Describe how osmosis develops in a plant cell? How the rules of osmosis can be best understood through the concept of tonicity of the solutions?
 - a. What is Endocytosis. Describe the different steps occurs in it.

SECTION-D (Marks 20)

Note: Attempt any TWO questions. All questions carry equal marks.

(2 × 10 = 20)

- Q.4 (a) Describe the structure and function of endoplasmic reticulum and Golgi apparatus?
(b) Discuss structure and function of mitochondria?
- Q.5 (a) Describe the major animal tissues in terms of their cell specificities, locations and functions?
(b) Discuss structure and function of Ribosomes?
- Q.6 (a) Describe the major plant tissues in terms of their cell specificities, locations and functions.
(b) Explain the phenomena of diffusion also describe its significance?

SOLUTION OF GUESS PAPER & MODEL PAPER # 4 (Reduced Syllabus)

SECTION- A (MCQs)

i. B	ii. C	iii. A	iv. D	v. B	vi. C
vii. D	viii. D	ix. C	x. B	xi. C	xii. D

SECTION-B (Marks 18)

Time allowed: 2:40 Hours

Total Marks: 53

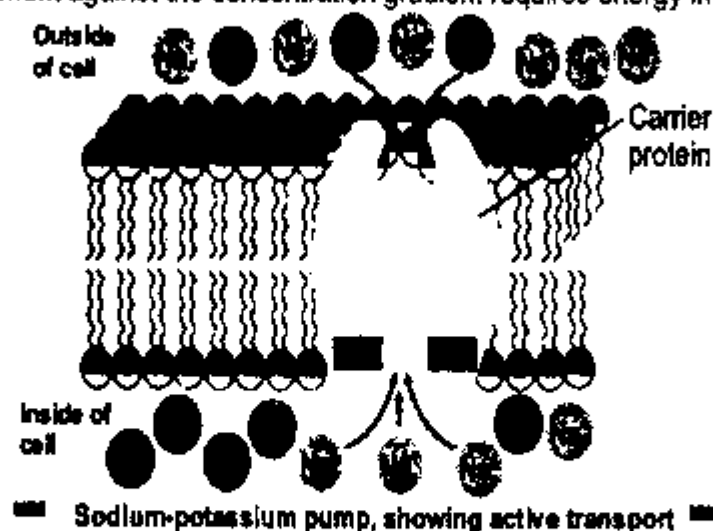
NOTE: Answer any six parts from Section 'B' and attempt any five parts from Section-C. Attempt any two questions from Section 'D' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

- Q.2 Attempt any SIX parts from the following. All parts carry equal marks. Be brief and to the point.
(6 × 3 = 18)

(I) Define active transport. Also describe its function.

Ans: Active Transport:

Active transport is the movement of molecules from an area of lower concentration to the area of higher concentration. This movement against the concentration gradient requires energy in the form of ATP.



Function of Active Transport:

In this process, carrier proteins in the cell membrane use energy to move the molecules against the concentration gradient. For example the membranes of nerve cells have carrier proteins in the form of

purpose, the pump actively moves Na^+ to the outside of the cell where they are already in higher concentration. Similarly this pumps moves K^+ from outside to inside the cell where they are in higher concentration.

(ii) What are the functions of leucoplasts and chromoplasts?

Ans: **Function of chromoplasts:**

The second type of plastids in plant cells are chromoplasts. They contain pigments associated with the bright colors and are present in the cells of flower petals and fruits. Their function is to give colors to these parts and thus help in pollination and dispersal of fruit.

Function of leucoplasts:

Leucoplasts are the third type of plastids. They are colourless and store starch, proteins and lipids. They are present in the cells of those parts where food is stored.

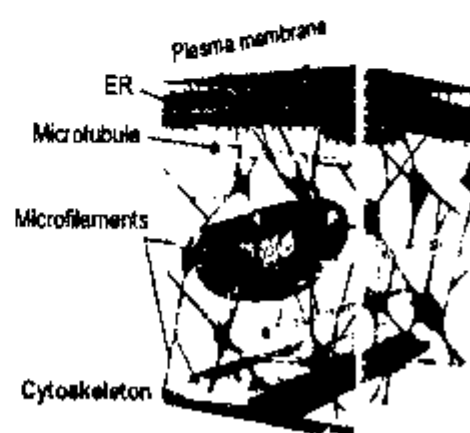
(iii) Describe the structure and function of Cytoskeleton?

Ans: **Structure Cytoskeleton:**

Cytoskeleton is a network of microfilaments and microtubules. Microtubules are made of tubulin protein and are used by cells to hold their shape. They are also the major component of cilia and flagella. Microfilaments are thinner and are made of actin protein.

Function of Cytoskeleton:

Cytoskeleton help cells to change their shapes.



(iv) Explain the functions of cell membrane?

Ans: **Function of Cell Membrane:**

All prokaryotic and eukaryotic cells have a thin and elastic cell membrane, covering the cytoplasm. The cell membrane functions as a semi-permeable barrier, allowing a very few molecules across it while fencing the majority of chemicals inside the cell. In this way the membrane maintains the internal composition of the cell to a constant or nearly constant level. In addition to this vital role, cell membrane can also sense chemical messages and can identify materials and other cells.

(v) Describe the structure of cell wall?

Ans: **Cell wall:**

The cell wall is a non-living and strong component of the cell, located outside the plasma membrane. It provides shape, strength, protection and support to the inner living matter (protoplasm) of the cell.

Structure of Cell wall:

Plant cells have a variety of chemicals in their cell walls. The outer layer of the plant cell wall is known as primary wall and cellulose is the most common chemical in it. Some plant cells, for example xylem cells, also have secondary walls on the inner side of the primary wall. It is much thicker and lignin and other chemicals are embedded in it. In the walls of neighbouring cells there are cytoplasmic connections called Plasmodesmata. Through these connections, cells transfer chemicals among each other.

Presence of Chitin In the Cell wall of fungi:

Fungi and many protists have cell walls although they do not contain cellulose. Their cell walls are made of a variety of chemicals. For example chitin is present in the cell wall of fungi. Prokaryotes have a cell wall composed of peptidoglycan that is a single large polymer of amino acids and sugar.

(vi) Differentiate between diffusion and facilitated diffusion?

Ans: **Difference between diffusion and facilitated diffusion:**

Feature	Diffusion	Facilitated Diffusion
Definition	Diffusion is the movement of molecules from an area of higher concentration to the area of lower concentration i.e. along the concentration gradient.	Facilitated diffusion is a type of diffusion across cell membrane in which transport-proteins are used to transport the substance from higher to lower

Chapter # 04

Cells and Tissues

Guess Papers

Carrier Proteins	No carrier proteins are required.	Carrier proteins are required.
Rate	Slower rate of diffusion.	Rapid rate of diffusion.
Examples	Gaseous exchange in gills.	Movement of ions across cell membrane.
	Movement of glucose from small intestine lumen into capillaries.	Movement of several water-soluble molecules across cell membrane.

(vii) Discuss nucleus structure and function?

Ans: **Nucleus:**

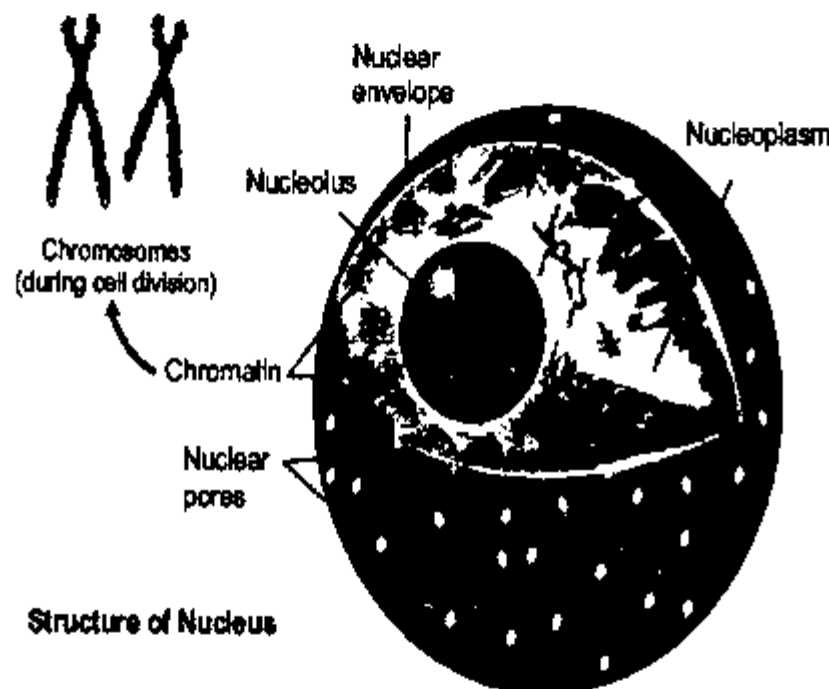
A prominent nucleus occurs in eukaryotic cells. In animal cells it is present in the center while in mature plant cells, due to the formation of large central vacuole, it is pushed to side.

Structure of Nucleus:

The nucleus is bounded by a double membrane known as nuclear envelope.

Nuclear Envelope:

The nuclear envelope contains many small pores that enable it to act as a differentially-permeable membrane.



Nucleoplasm:

Inside the nuclear envelope a granular matrix, the nucleoplasm is present. The nucleoplasm contains one or two nucleoli (singular; nucleolus) and chromosomes

Nucleolus:

Nucleolus is a dark spot and it is the site where ribosomal RNA are formed and assembled as ribosomes.

Chromosomes:

Chromosomes are visible only during cell division while during interphase (non-dividing phase) of cell they are in the form of fine thread-like structures known as chromatin.

Structure of DNA: Chromosomes are composed of Deoxyribonucleic acid (DNA) and proteins.

Note: The prokaryotic cells do not contain prominent nucleus. Their chromosome is made of DNA only and is submerged in cytoplasm.

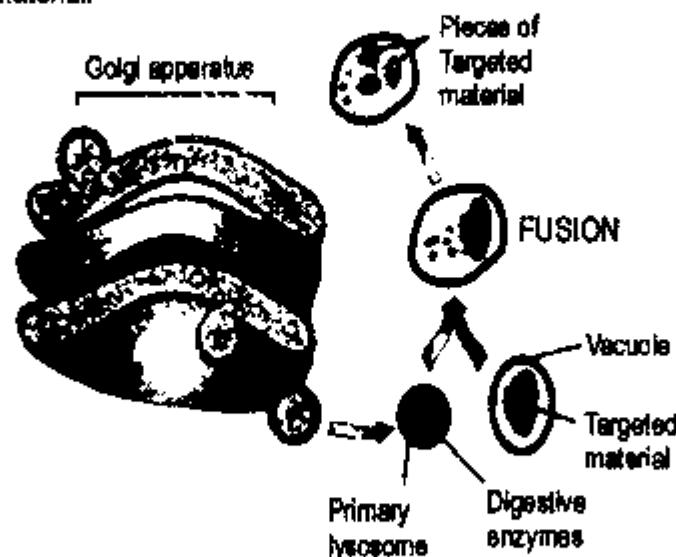
(viii) Describe the formation and function of lysosomes?

Ans: **Lysosomes:**

In the mid-twentieth century, the Belgian scientist Christian Rene de Duve discovered lysosomes.

Function of lysosomes:

During its function, a lysosome fuses with the vacuole that contains the targeted material and its enzymes break down the material.



Formation and Function of lysosome

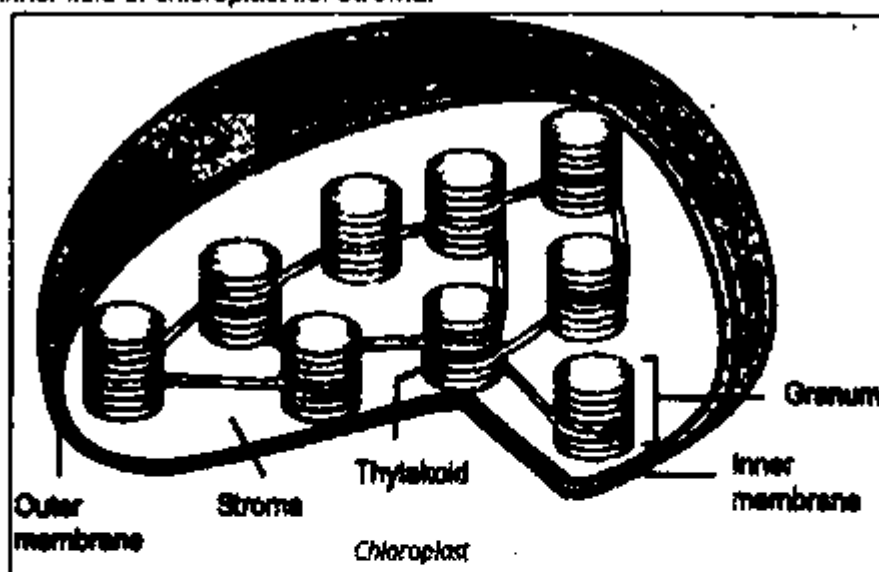
SECTION-C (Marks 15)

Q.3 Attempt any FIVE parts from the following. All parts carry equal marks. Be brief and to the point. (5 × 3 = 15)

(i) Describe the internal structure of chloroplast and compare it with that of mitochondrion?

Ans: Like mitochondria, chloroplast is also bound by a double membrane. The outer membrane is smooth while the inner one gives rise to membranous sacs called **thylakoids**. The stack of thylakoids is known as a **granum** [plural = grana].

Grana float in the inner fluid of chloroplast i.e. **stroma**.



Function of chloroplast:

Chloroplasts are the sites of photosynthesis in eukaryotes. They contain chlorophyll, the green pigment necessary for photosynthesis, and associated accessory pigments. These pigments are present in thylakoids of the grana of chloroplasts.

(ii) Explain the phenomena involved in the passage of matter across cell membrane?

Ans: Chemical analysis reveals that cell membrane is mainly composed of proteins and lipids with small quantities of carbohydrates. Electron microscopic examinations of cell membranes have led to the development of the fluid-mosaic model of cell membrane.

Chapter # 04

Cells and Tissues

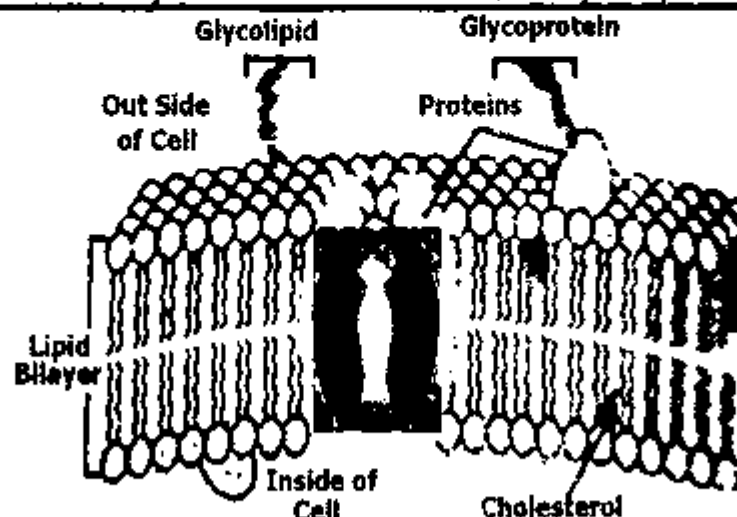
Guess Papers

membranes. These are joined with proteins or lipids of membrane. In eukaryotic cells, cholesterol is also present in lipid bilayer.

In eukaryotic cell many organelles e.g. mitochondria, chloroplasts, Golgi apparatus, and endoplasmic reticulum are also bounded by cell membranes.

When we talk about all the membranes of a cell, we say them as cell membranes.

When we talk about only the outer membrane of cell, we say it as plasma membrane.



The fluid – mosaic model of cell membrane

(iii) Describe how turgor pressure develops in a plant cell?

Ans: Most plant cells live in hypotonic environment because there is low concentration of solutes in extracellular fluids than in their cells. As a result water tends to move first inside the cell and then inside the vacuole. When vacuole increases in size the cytoplasm presses firmly against the interior of the cell wall, which expands a little. Due to strong cell wall, plant cell does not rupture but instead becomes rigid. The internal pressure of such a rigid cell is known as turgor pressure and this phenomenon is known as turgor.

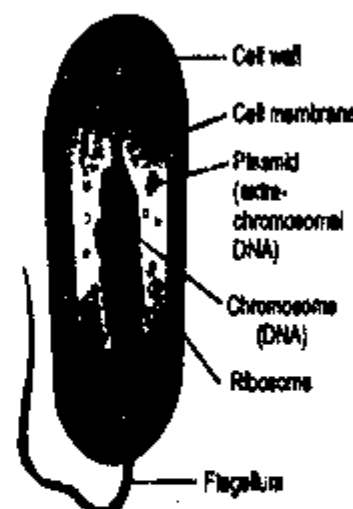
(iv) Describe the differences in prokaryotic and eukaryotic cells?

Ans: Difference between Prokaryotic and Eukaryotic Cells:

Prokaryotes possess prokaryotic cells which are much simpler than the eukaryotic cells.

The main differences between prokaryotic and eukaryotic cells are given below.

Nucleus:	Eukaryotic cells have prominent nucleus (bounded by nuclear envelope) while prokaryotic cells do not have prominent nucleus. Their chromosome consists of DNA only and it floats in cytoplasm near centre. This region is called nucleoid.
Other Organelles:	Eukaryotic cells have membrane-bounded organelles like mitochondria, Golgi apparatus, endoplasmic reticulum etc. while such membrane-bounded organelles are not present in prokaryotic cells. The ribosomes of eukaryotic cells are larger in size as compared to the ribosomes of prokaryotic cells.
Size:	Eukaryotic cells are, on average, ten times larger than prokaryotic cells.
Cell Wall:	The cell wall of eukaryotic cell is made of cellulose (in plants) or chitin (in fungi). All prokaryotic cells have cell wall, which is made of peptidoglycan (a large polymer of amino acids and sugars).



A general prokaryotic cell

(v) Describe how osmosis develops in a plant cell? How the rules of osmosis can be best understood through the concept of tonicity of the solutions?

Chapter # 04

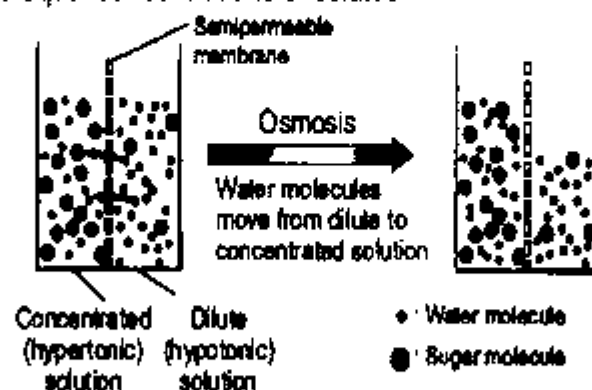
Cells and Tissues

Guess Papers

Rules of osmosis and concept of tonicity of the solutions:

The rules of osmosis can be best understood through the concept of tonicity of the solutions. The term tonicity refers to the relative concentration of solutes in the solutions being compared.

- A Hypertonic solutions are those in which more solute is present.
- A Hypotonic solutions are those with less solute.
- Isotonic solutions have equal concentrations of solutes.



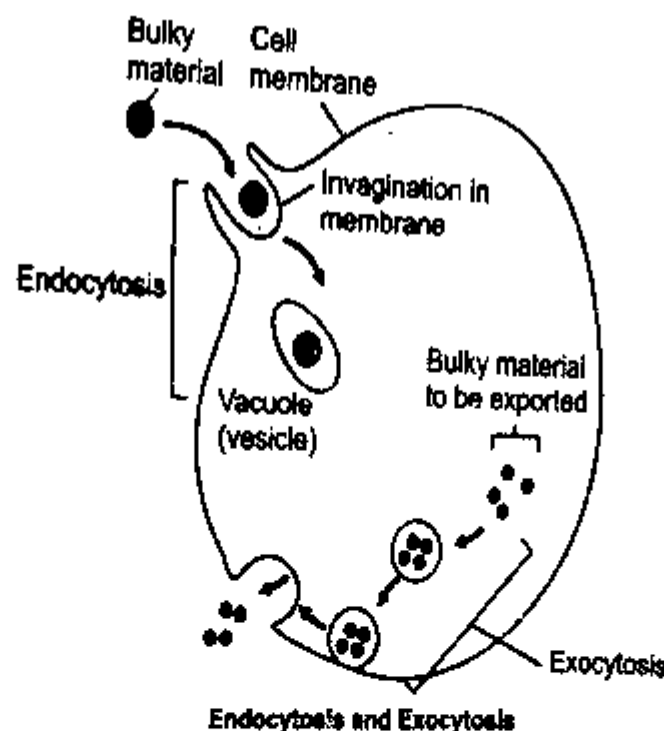
Explanation:

In a hypertonic solution the solute molecules attract clusters of water molecules, so that fewer water molecules are free to diffuse across the membrane. On the other hand in a hypotonic solution with fewer solute molecules, there are more free water molecules and there is net movement of water from hypotonic solution to the hypertonic solution.

(vi) a. What is Endocytosis. Describe the different steps occurs in it.

Ans: Endocytosis:

It is the process of cellular ingestion of bulky materials by the infolding of cell membrane (see the steps of endocytosis in Figure).



Types of Endocytosis:

The two forms of endocytosis are phagocytosis (cellular eating) and pinocytosis (cellular drinking). In phagocytosis cell takes in solid material while in pinocytosis cell takes in liquid in the form of droplets.

b. What is Exocytosis. Describe the different steps occurs in it.

Ans: Exocytosis: It is the process through which bulky material is exported

(vii) Describe the formation and function of Centrioles?

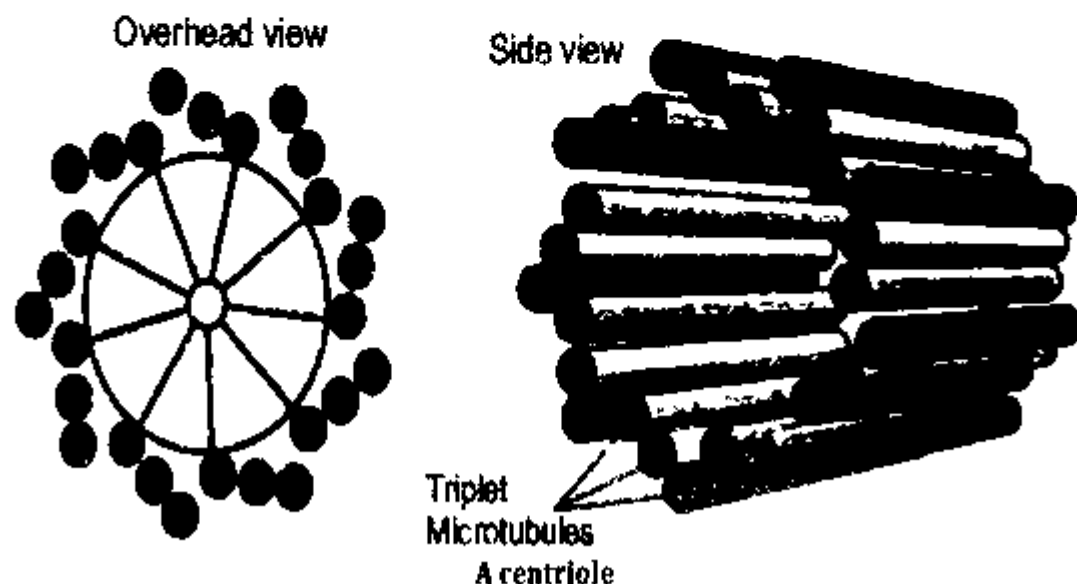
Ans: Centrioles:

Animals and many unicellular organisms have hollow and cylindrical organelles known as centrioles.

Formation of Centrioles:

Animals and many unicellular organisms have hollow and cylindrical organelles known as centrioles.

Each centriole is made of nine triplets of microtubules (made up of tubulin protein). Animal cells have two centrioles located near the exterior surface of nucleus. The two centrioles are collectively called a centrosome.



Function of Centrioles:

Their function is to help in the formation of spindle fibers during cell division. In some cells, centrioles are involved in the formation of cilia and flagella.

SECTION- C

Q.4 (a) Describe the structure and function of endoplasmic reticulum and Golgi apparatus?

Ans: See Q3(a), FBSE Paper (2015), Page # 106.

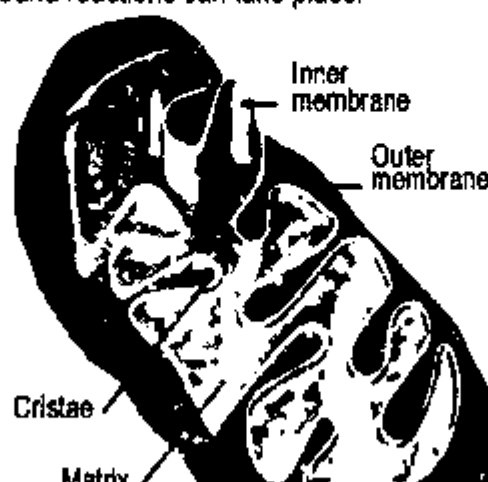
(b) Discuss structure and function of mitochondria?

Ans: Mitochondria:

Mitochondria (singular: mitochondrion) are the double membrane-bounded structures found only in eukaryotes. These are the sites of aerobic respiration, and are the major energy production centers.

Structure of mitochondria:

The outer membrane of mitochondria is smooth but the inner membrane forms many infoldings, called cristae (singular crista) in the inner mitochondrial matrix. This serves to increase the surface area of the inner membrane on which membrane-bound reactions can take place.



Function of mitochondria:

Mitochondria have their own DNA and their own ribosomes; and those ribosomes are more similar to bacterial ribosomes than to eukaryotic ribosomes.

Q.5 (a) Describe the major animal tissues in terms of their cell specificities, locations and functions?

Ans: See Q3(a). F.BISE Paper (2019), Page # 131.

(b) Discuss structure and function of Ribosomes?

Ans: Ribosomes:

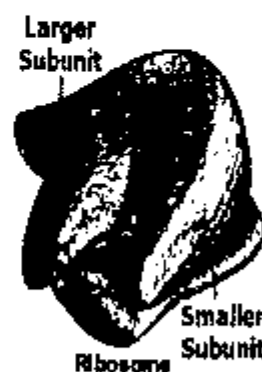
Ribosomes are tiny granular structures that are either floating freely in the cytoplasm or are bound to the endoplasmic reticulum (ER).

Structure of Ribosomes:

Each ribosome is made up of almost equal amounts of proteins and ribosomal RNA (rRNA). Ribosomes are not bound by membranes and so are also found in prokaryotes. Eukaryotic ribosomes are slightly larger than prokaryotic ones.

Function of Ribosomes:

Ribosomes are the sites of protein synthesis. Protein synthesis is extremely important to cells, and so large numbers of ribosomes are found throughout cells. When a ribosome is not working, it disassembles into two smaller units.



Q.6 (a) Describe the major plant tissues in terms of their cell specificities, locations and functions.

Ans: See Q3(a). F.BISE Paper (2014), Page # 101.

(b) Explain the phenomena of diffusion also describe its significance?

Ans: Diffusion:

Diffusion is the movement of molecules from an area of higher concentration to the area of lower concentration i.e. along concentration gradient.

Explanation:

The molecules of any substance (solid, liquid or gas) are in motion when that substance is above 0 degrees Kelvin or -273 degrees Centigrade. In a substance, majority of the molecules move from higher to lower concentration, although there are some that move from low to high. The overall (or net) movement is thus from high to low concentration.

Eventually, the molecules reach a state of equilibrium where they are distributed equally throughout the area.

Significance of diffusion:

Diffusion is one principle method of movement of substances within cells, as well as across cell membrane. Carbon dioxide, oxygen, glucose etc. can cross cell membranes by diffusion. Gas exchange in gills and lungs occurs by this process. Movement of glucose molecules from small intestine lumen into the blood capillaries of villi is another example of diffusion.

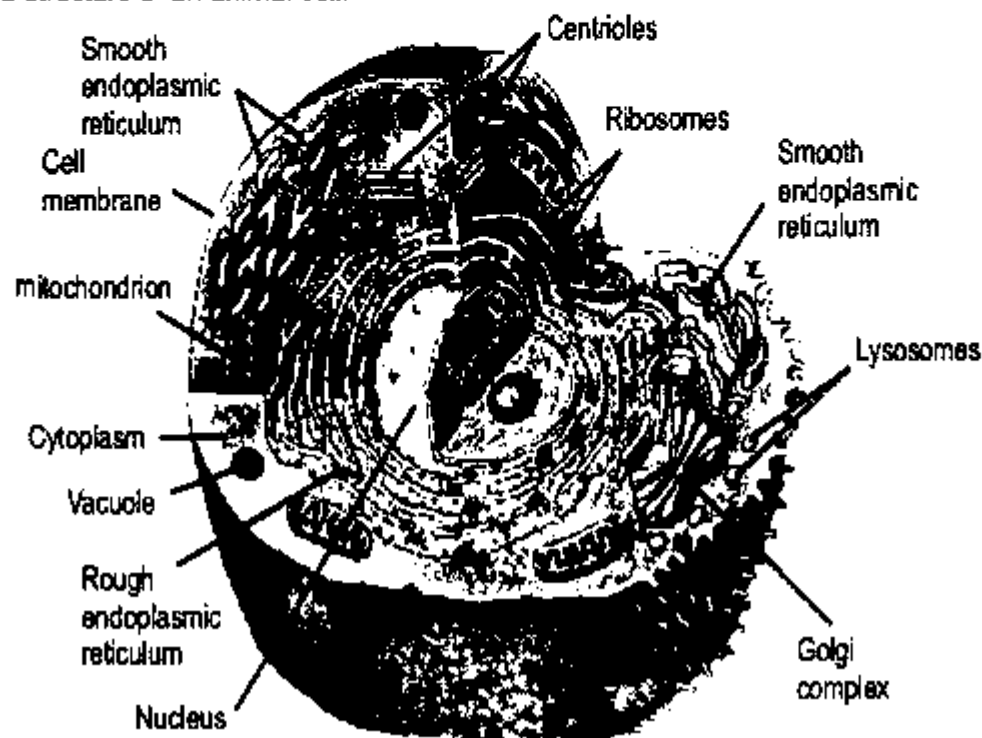
Passive Transport:

Because a cell does not expend energy when molecules diffuse across its membrane, the diffusion is type of passive transport.

Important Questions and Answers

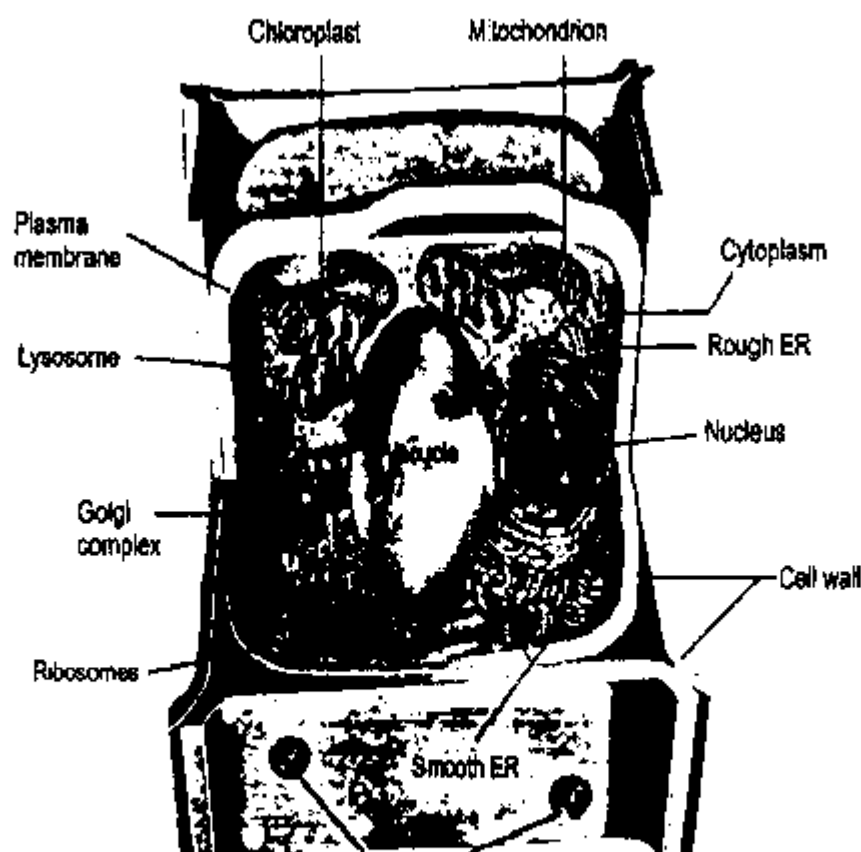
Q1. Draw the Ultra structure of animal cell.

Ans: The ultra-structure of an animal cell.



Q2. Draw the Ultra structure of a plant cell.

Ans: Ultra structure of a plant cell.



Q3. Describe the formation and function of Cytoplasm?

Ans: Formation of Cytoplasm:

Cytoplasm is the semi-viscous and semi-transparent substance between plasma membrane (cell membrane) and nuclear envelope. It contains water in which many organic molecules (proteins, carbohydrates, lipids) and inorganic salts are completely or partially dissolved.

Function of Cytoplasm:

Cytoplasm provides space for the proper functioning of organelles and also acts as the site for various biochemical (metabolic) reactions.

For example, Glycolysis (breakdown of glucose during cellular respiration) occurs in cytoplasm.

Q4. What are the cell Organelles?

Ans: Cell Organelles:

Organelles are small structures within cells that perform dedicated functions. There are about a dozen types of organelles commonly found in eukaryotic cells.

Q5. What are the plastids?

Ans: Plastids: Plastids are also membrane-bound organelles that only occur in plants and photosynthetic protists (algae).

Types of Plastids: Plastids are of three type.

1. Chloroplasts
2. Leucoplasts
3. Chromoplasts

Q6. Describe the internal structure of chromoplasts?

Ans: Chromoplasts:

The second type of plastids in plant cells are chromoplasts. They contain pigments associated with the bright colors and are present in the cells of flower petals and fruits. Their function is to give colors to these parts and thus help in pollination and dispersal of fruit.

Q7. Describe the internal structure of Leucoplasts?

Ans: Leucoplasts:

Leucoplasts are the third type of plastids. They are colourless and store starch, proteins and lipids. They are present in the cells of those parts where food is stored.

Q8. What is the advantage of the compartmentalization of the eukaryotic cell?

Ans: We can see an advantage of the compartmentalization of the eukaryotic cell. the cell could not support such destructive enzymes if they were not contained in a membrane bound lysosome.

Q9. Which of the following organelles does not belong to others in the list: mitochondrion, chloroplast, ribosome, lysosome. Why?

Ans: Ribosome, because they are not membrane bounded

Q10. State the fascinating theory of symbiosis (living together) which explains the evolution of eukaryotic cells?

Ans: The existence of double membrane has led many biologists to theorize that mitochondria are the descendants of some bacteria that were engulfed by a larger prokaryotic cell billions of years ago. This fascinating theory of symbiosis (living together) explains the evolution of eukaryotic cells.

Q11. What can happen when a lysosome bursts inside the cell and all its enzymes are released in the cytoplasm?

Ans: The cell could not support such destructive enzymes if they were not contained in a membrane bound lysosome.

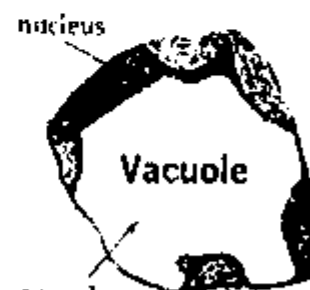
Q12. State the working and function of Vacuoles?

Ans: Vacuoles:

Vacuoles are fluid filled single-membrane bound organelles. Cells have many small vacuoles in their cytoplasm.

Function and working of Vacuoles:

When a plant cells matures its small vacuoles absorb water and fuse to form a single large vacuole in the center. The cell is then called a mature cell.



Q13. Describe the similarities in prokaryotic and eukaryotic cells?

Ans: Similarities between Prokaryotic and Eukaryotic Cells:

- i. They both have DNA as their genetic material.
- ii. They are both membrane bound.
- iii. They both have ribosome.
- iv. They have similar basic metabolism.
- v. They are both amazingly diverse in forms.

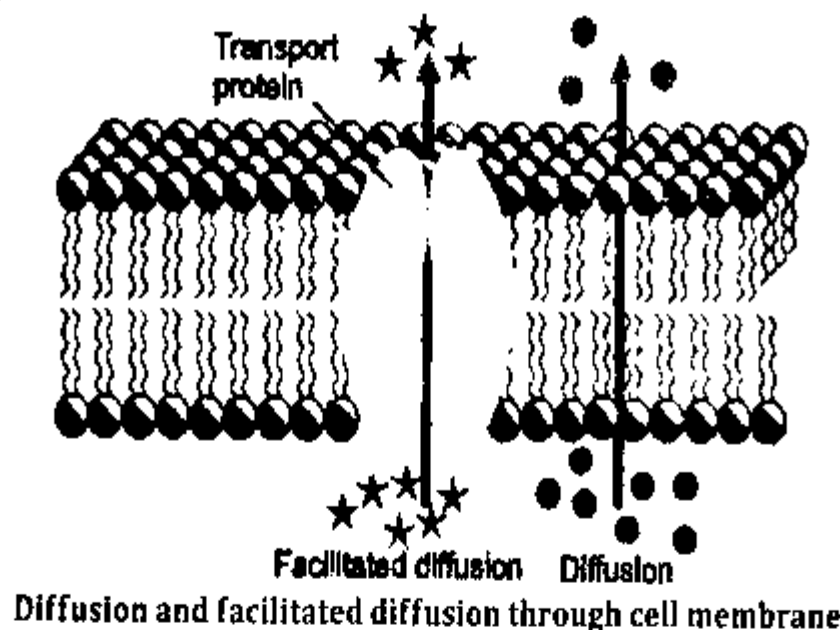
Q14. Explain the phenomena of Facilitated diffusion also describe why it is called passive transport?

Ans: Facilitated Diffusion:

Many molecules do not diffuse freely across cell membranes because of their size or charge. Such molecules are taken into or out of the cells with the help of transport proteins present in cell membranes. When a transport protein moves a substance from higher to lower concentration, the process is called facilitated diffusion. The rate of facilitated diffusion is higher than simple diffusion.

Facilitated diffusion is a type of passive transport:

Facilitated diffusion is also a type of passive transport because there is no expenditure of energy in this process (Figure).



Q15. Why a colony of cells does not get tissue level of organization?

Ans: In a colony of cells, there are many cells and each cell performs all general functions on its own. Such a group does not get tissue level of organization because cells are not specific and there is no coordination among them.

Chapter # 5

Cell Cycle

Topics Included:

- Cell Cycle (87-88)
- Mitosis and Its Phases (89-91)
- Meiosis and Its Phases (95-100)
- Comparison Between Mitosis and Meiosis (101)

GUESS PAPER & MODEL PAPER # 5 BASED ON CHAPTER # 5 (Reduced Syllabus) CELL CYCLE

BIOLOGY SSC-I SECTION-A

Time allowed: 20 Minutes

Marks: 12

NOTE:- Section-A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 20 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q.1 Encircle the correct option i.e. A / B / C / D. All parts carry equal marks.

i. In which stage of the cell cycle each chromosome is duplicated and so it consists of two chromatids?

- A. G1 B. S C. M D. G2

ii. If you observe a cell like this one, what phase of mitosis is it?

- A. Anaphase B. Telophase
C. Metaphase D. Prophase



iii. During which phase of mitosis spindles are formed?

- A. G2 B. Interphase C. Prophase D. Metaphase

iv. In which stage of the cell cycle, the cell is preparing to begin DNA replication?

- A. G1 B. G2 C. S D. M

v. Which of the following features of cell division are very different for animal and plant cells?

- A. Prophase B. Metaphase C. Anaphase D. Cytokinesis

vi. Prior to cell division, each chromosome replicates or duplicates its genetic material. The products are connected by a centromere and are called;

- A. Sister chromosomes B. Homologous chromosomes
C. Sex chromosomes D. Sister chromatids

vii. The process of mitosis ensures that;

- A. Each new cell is genetically different from its parent
B. Each new cell receives the proper number of chromosomes
C. Cells will divide at the appropriate time
D. DNA is replicated without errors

viii. Cytokinesis in a plant cell is characterized by;

- ix. Which of the following is unique to mitosis and not a part of meiosis I?
A. Homologous chromosomes pair forming bivalents
B. Homologous chromosomes cross over
C. Chromosome pairs are broken during anaphase
D. Chromatids separate during anaphase
- x. Which event distinguishes meiosis from mitosis?
A. Condensation of chromosomes
B. Loss of the nuclear membrane
C. Formation of metaphase plate
D. Pairing of homologous chromosomes
- xi. In which stage of the cell cycle most cells spend their lives?
A. Prophase
B. Metaphase
C. Interphase
D. Telophase
- xii. Which of the following distinguishes meiosis from mitosis?
A. In meiosis, the chromosome number is reduced
B. In meiosis, the daughter cells are genetically different from the parent cell
C. In meiosis, at least some of the daughter cells differ genetically from each other
D. All of the above.

BIOLOGY SSC-I

Time allowed: 2:40 Hours

Total Marks: 53

NOTE: Answer any six parts from Section 'B' and attempt any five parts from Section-C. Attempt any two questions from Section 'D' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

SECTION-B (Marks 18)

- Q.2 Attempt any SIX parts from the following. All parts carry equal marks. Be brief and to the point. (6 × 3 = 18)
- (i) A never cell does not divide after its formation. In which phase of cell cycle it is?
 - (ii) How is cytokinesis different in plant cells as compared to animal cell?
 - (iii) What type of cell division occurs when our wounds are healed?
 - (iv) Plants do not make their gametes by meiosis. How is that?
 - (v) Why meiosis called a reductional division?
 - (vi) The S-phase of interphase is important and a cell can never divide without it. Justify.
 - (vii) How would you state the events of prophase of mitosis?
 - (viii) Make a list of the events of mitosis.

SECTION-C (Marks 15)

- Q.3 Attempt any FIVE parts from the following. All parts carry equal marks. Be brief and to the point. (5 × 3 = 15)
- (i) What is centrosome.
 - (ii) Nucleus is visible only in interphase while chromosomes are only visible in cell division stage. Why is that?
 - (iii) Describe the difference between meiosis and mitosis?
 - (iv) Differentiate between open mitosis and closed mitosis?
 - (v) What is the function of inhibition of protein synthesis during G2 phase?
 - (vi) Why prokaryotes cannot be properly said to undergo mitosis?
 - (vii) Contrast mitosis and meiosis, emphasizing the events that lead to different outcomes.

SECTION-D (Marks 20)

Note: Attempt any TWO questions. All questions carry equal marks.

(2 × 10 = 20)

SOLUTION OF GUESS PAPER & MODEL PAPER # 5 (Reduced Syllabus)

SECTION- A (MCQs)

i. B	ii. A	iii. A	iv. A	v. D	vi. D
vii. B	viii. C	ix. D	x. D	xi. C	xii. A

SECTION-B (Marks 18)

Time allowed: 2:40 Hours

Total Marks: 53

NOTE: Answer any six parts from Section 'B' and attempt any five parts from Section-C. Attempt any two questions from Section 'D' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

Q.2 Attempt any SIX parts from the following. All parts carry equal marks. Be brief and to the point. (6 × 3 = 18)

(i) A never cell does not divide after its formation. In which phase of cell cycle it is?

Ans: Cell that have temporarily or permanently stopped dividing are said to have entered a state of quiescence, called G₀ phase

(ii) How is cytokinesis different in plant cells as compared to animal cell?

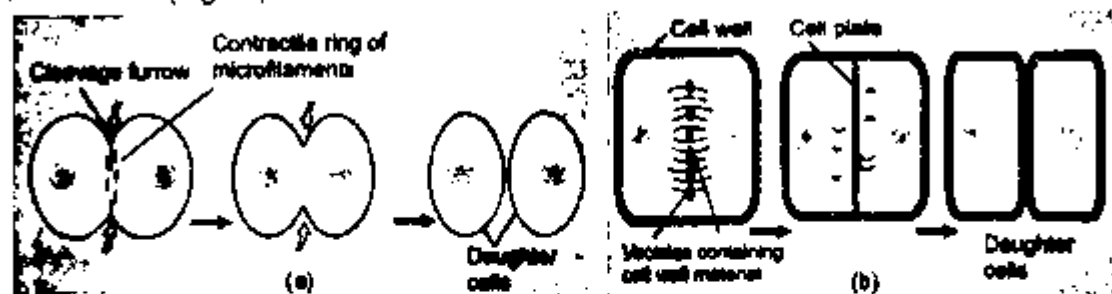
Ans: **Cytokinesis:** Cytokinesis is the division of cytoplasm.

Cytokinesis in animal cells:

In animal cells, cytokinesis occurs by a process known as cleavage. A cleavage furrow develops where the metaphase plate used to be. The furrow deepens and eventually pinches the parent cell into two daughter cells.

Cytokinesis in plant cells:

Cytokinesis in plant cells occurs differently. Vesicles derived from the Golgi apparatus move to the middle of cell and fuse to form a membrane-bounded disc called cell plate or phragmoplast. The plate grows outward and more vesicles fuse with it. Finally, membranes of cell plate fuse with plasma membrane and its contents join the parental cell wall. The result is two daughter cells, each bounded by its own plasma membrane and cell wall (Figure).



Cytokinesis, (a) in animal cell, (b) in plant cell

(iii) What type of cell division occurs when our wounds are healed?

Ans: Mitosis occurs when our wounds are healed. The number of cells within an organism increases by mitosis and this is the basis of development from a single cell zygote to the multicellular body and the growth.

When damaged tissues (wounds) are repaired (healed), the new cells must be exact copies of the cells being replaced so as to retain normal function of cells.

(iv) Plants do not make their gametes by meiosis. How is that?

Ans: Plants have an "alternation of generations". The gametes are produced by the "gametophyte" generation. The gametophyte generation is haploid, so the cells that become the gametes are actually produced by mitotic cell division.

(v) Why meiosis called a reductional division?

Ans: Meiosis is called reduction division because it reduces the number of chromosomes from diploid to haploid i.e. it gets reduced from $2N$ to $1N$ (46 to 23) so as to maintain the species-specific number 46 chromosomes (23 pairs) from generation to generation.

(vi) The S-phase of interphase is important and a cell can never divide without it. Justify.

Ans: The S-phase is known as the replication phase of the cell cycle. During this phase, the cell's genetic material or 'DNA' is copied. Since the DNA contains all of the information that a cell needs to produce essential materials, like proteins and enzymes, a cell can never divide without first going through this phase. DNA must be duplicated in the S-phase before cell division occurs. If not, the result will be 2 daughter cells with missing/un-equal amounts of genetic information. Consequently, the daughter cells will not be able to function properly and are likely to succumb to apoptosis (programmed cell death).

OR (Second Answer)

In the S-Phase, the most important part of cell cycle, the DNA (genome) replicates. It is then followed by division of the cell. If the s-phase fails to occur, a checkpoint before the division phase prevents the further proceedings of the cell cycle. Hence without the happening of S-phase, cell division will never complete.

OR (Second Answer)

S-phase of interphase:

Mitosis is the type of cell division in which a cell divides into two daughter cells, each with the genetic equivalent of the parent cell i.e. same number of chromosomes as were present in the parent cell. Because each resultant daughter cell should be genetically identical to the parent cell, the parent cell must make a copy of each chromosome before mitosis. This occurs during S phase of interphase.

(vii) How would you state the events of prophase of mitosis?

Ans: Events of Prophase:

Chromatin:

Normally, the genetic material in the nucleus is in a loose thread-like form called chromatin.

Chromosomes:

At the onset of prophase, chromatin condenses into highly ordered structures called chromosomes. Since the genetic material has already been duplicated earlier in S phase, each chromosome is made of two sister chromatids, bound together at the centromere. Each chromosome has kinetochore at the centromere. A kinetochore is a complex protein structure that is the point where spindle fibers attach.

Centrosome:

Close to the nucleus are two centrioles collectively called a centrosome. Each centriole replicates and thus two daughter centrosomes are formed. Each daughter centrosome acts as a coordinating center for the cell's microtubules.

Mitotic Spindle:

The two centrosomes give rise to microtubules by polymerizing (joining monomers to form polymers) the tubulin proteins present in the cytoplasm. The microtubules thus formed are called spindle fibers, and the complete set of the spindle fibers is known as **mitotic spindle**. During the formation of mitotic spindle, the centrosomes migrate to opposite side of the nucleus. The nucleolus and the nuclear envelope have degraded, and spindle fibers have invaded the central space.

Aggregation of Tubulin Proteins:

In highly vacuolated plant cells, the nucleus has to migrate into the center of the cell before prophase. The cells of plants lack centrioles. Instead, spindle fibers are formed by the aggregation of tubulin proteins on the surface of the nuclear envelope during prophase.

(viii) Make a list of the events of mitosis.

Ans: Events of Mitosis:

The process of mitosis is complex and highly regulated. The sequence of events is divided into major phases.

1. **Karyokinesis:** The division of the nucleus known as karyokinesis.

SECTION-C (Marks 15)

Q.3 Attempt any FIVE parts from the following. All parts carry equal marks. Be brief and to the point. (5 × 3 = 15)

(i) What is centrosome.

Ans: Centrosome:

Close to the nucleus are two centrioles collectively called a centrosome. Each centriole replicates and thus two daughter centrosomes are formed. Each daughter centrosome acts as a coordinating center for the cell's microtubules.

(ii) Nucleus is visible only in interphase while chromosomes are only visible in cell division stage. Why is that?

Ans: Nuclear membrane breaks during cell division so there is no distinct nucleus. In interphase nuclear material is in the form of fine chromatin which condenses during prophase to get the shape of chromosomes.

(iii) Describe the difference between meiosis and mitosis?

Ans: Difference between Meiosis and Mitosis:

Meiosis	Mitosis
Meiosis is used in sexual reproduction of organisms to combine male and female, through the spermatozoa and egg, to create a new, singular biological organism.	Mitosis is used by single celled organisms to reproduce, or in the organic growth of tissues, fibers and membranes.

(iv) Differentiate between open mitosis and closed mitosis?

Ans: Difference between open mitosis and closed mitosis:

In common mitosis, nuclear envelope disappears and spindles are formed inside the cytoplasm. It is called "open mitosis". Fungi and some protists undergo a variation called "closed mitosis" where the spindle forms inside the nucleus.

(v) What is the function of inhibition of protein synthesis during G2 phase?

Ans: Inhibition of protein synthesis during G2 phase prevents the cell from undergoing mitosis.

(vi) Why prokaryotes cannot be properly said to undergo mitosis?

Ans: Prokaryotic cells undergo a process similar to mitosis called binary fission. However, prokaryotes cannot be properly said to undergo mitosis because they lack a nucleus and only have a single chromosome with no centromere.

(vii) Contrast mitosis and meiosis, emphasizing the events that lead to different outcomes.

Ans: Comparison between Mitosis and Meiosis:

Meiosis II is similar to mitosis while meiosis I makes the actual difference between these two cell divisions. The following chart describes the main differences between mitosis and meiosis I.

Contrast between mitosis and meiosis:

Mitosis	Meiosis
1. Mitosis takes place in somatic cells.	1. Meiosis takes place in gonads.
2. Mitosis results in two daughter cells.	2. Meiosis results in four daughter cells.
3. No crossing over takes place.	3. Crossing over between homologous chromosomes takes place.
4. Number of chromosomes remain same as in parent cell.	4. Number of chromosomes to half as compared to the parent cell.
5. Daughter cells remain diploid.	5. Daughter cells become from the diploid parent cell.

SECTION-D (Marks 20)

Q.5 Describe the events that occur during the phases of meiosis-I?

Ans: Phases of Meiosis:

Meiosis was discovered and described for the first time in 1876, by a German biologist Oscar Hertwig. The preparatory steps of meiosis are identical to the interphase of mitosis. Interphase is divided into the same three phases i.e. G₁, S phase, and G₂. Interphase is followed by meiosis I and meiosis II.

Meiosis I: In meiosis I, the homologous chromosomes in a diploid cell separate and so two haploid daughter cells are produced. It is the step in meiosis that generates genetic variations.

Steps involved in Meiosis I: Meiosis I occurs in two main steps i.e. karyokinesis and cytokinesis.

Sub division of Karyokinesis of Meiosis I:

The karyokinesis of Meiosis I is subdivided into prophase I, metaphase I, anaphase I, and telophase I.

Prophase I: Prophase I is the longest phase in meiosis. During this stage, chromatin condenses into chromosomes.

Synapsis: The homologous chromosomes line up with each other and form pairs by a process called synapsis.

Bivalent: Each pair of homologous chromosomes is called bivalent.

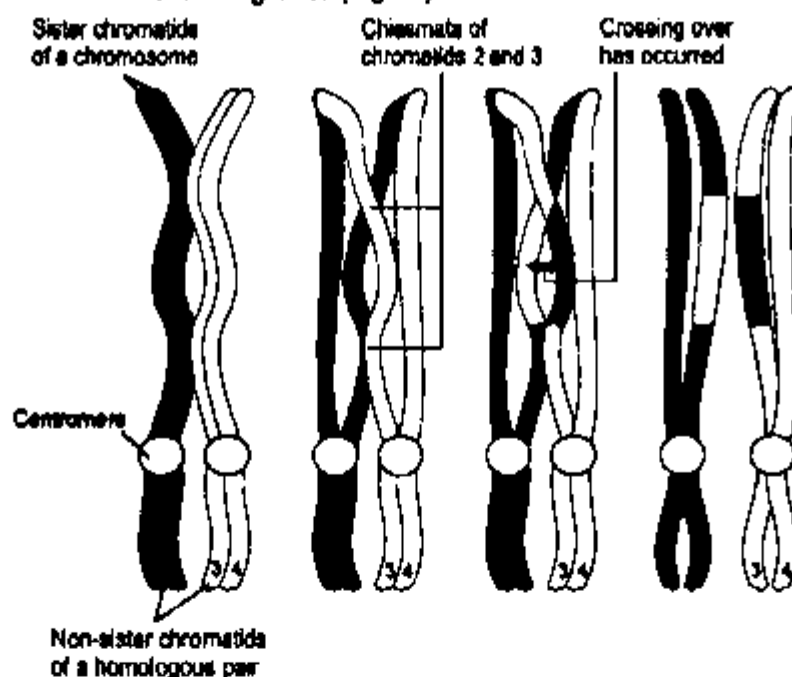
Tetrad: Each bivalent has four chromatids, so it may also be called a tetrad.

Chiasmata:

The two non-sister chromatids of homologous chromosomes join each other at certain points along their length. These points of attachment are called chiasmata.

Crossing over:

In the next stage, the non-sister chromatids of homologous chromosomes exchange their segments and the phenomenon is known as **crossing over** (Figure).



Crossing over

The exchange of segments results in the recombination of genetic information. After crossing over, each pair of homologous chromosomes remain as a bivalent.

Spindle fibres:

Chromosomes condense further, the nucleoli disappear, and the nuclear envelope disintegrates. Centrioles, which were duplicated during interphase, migrate to the two poles and form spindle fibres. The kinetochore spindle fibres attach with the kinetochores of chromosomes. While the nonkinetochore spindle fibres from both sides interact with each other. Two kinetochore spindle fibres (from the opposite poles) attach with a pair of chromosomes. In mitosis, we have seen that two kinetochore spindle fibres attach with one chromosome.

Metaphase I: The pairs of homologous chromosomes align along equatorial plane forming the metaphase plate.

Anaphase I:

Chapter # 05

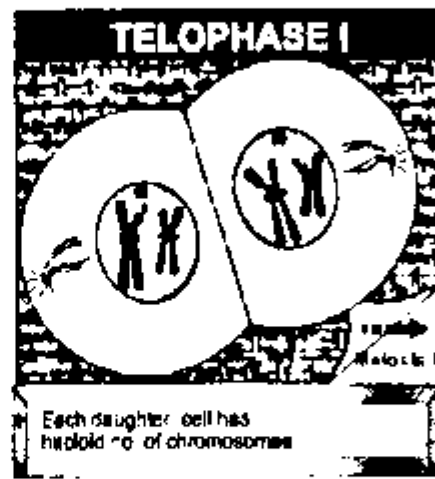
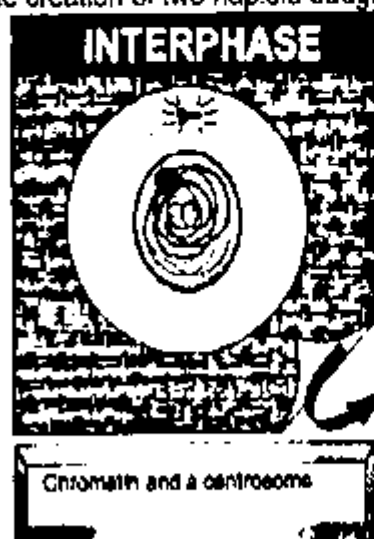
Cell Cycle

Guess Papers

Telophase I:

Chromosomes arrive at the poles. Each pole now has half the number of chromosomes but each chromosome still consists of two chromatids. Spindle network disappears, and nuclear envelope is formed around each haploid set. Chromosomes uncoil back into chromatin.

Cytokinesis (the pinching of the cell membrane in animal cells or the formation of the cell wall in plant cells) occurs and the creation of two haploid daughter cells is completed (Figure).



Stages in Meiosis - I

After meiosis I both haploid daughter cells enter a period of rest known as interkinesis or interphase II. The interphase II is different from the interphase of mitosis and meiosis I. There is no S-phase and so there is no duplication of chromosomes during this stage.

Chapter # 6

Enzymes

Topics Included:

- Enzyme Introduction (107-108)
- Characteristics of Enzymes (108-109)
- Factors Affecting Rate of Enzyme Action (109-111)
- Mechanism Of Enzyme Action (111-112)

GUESS PAPER & MODEL PAPER # 6 BASED ON CHAPTER # 6 (Reduced Syllabus) ENZYMES

BIOLOGY SSC-I SECTION-A

Time allowed: 20 Minutes

Marks: 12

NOTE:- Section-A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 20 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q.1 Encircle the correct option i.e. A / B / C / D. All parts carry equal marks.

i. What is TRUE about enzymes?

- A. They make biochemical reactions to proceed spontaneously
- B. They lower the activation energy of a reaction
- C. They are not very specific in their choice of substrates
- D. They are needed in large quantities

ii. To what category of molecules do enzymes belong?

- A. Carbohydrates
- B. Lipids
- C. Nucleic acids
- D. Proteins

iii. What is TRUE about cofactors?

- A. Break hydrogen bonds in proteins
- B. Help facilitate enzyme activity
- C. Increase activation energy
- D. Are composed of proteins

iv. Prosthetic groups are;

- A. Required by all enzymes
- B. Loosely attached with enzymes
- C. Proteins in nature
- D. Tightly bound to enzyme

v. When we add more substrate to an already occurring enzymatic reaction and there is no increase in the rate of reaction, what would you predict?

- A. All active site have been occupied by substrate molecules
- B. The enzyme molecules have denatured
- C. More substrate acted as inhibitor
- D. More substrate has disturbed the pH of the medium

vi. The enzyme that digests the lipids into glycerol and fatty acids

- A. Lipase
- B. Amylase
- C. Biocatalyst
- D. Substrate

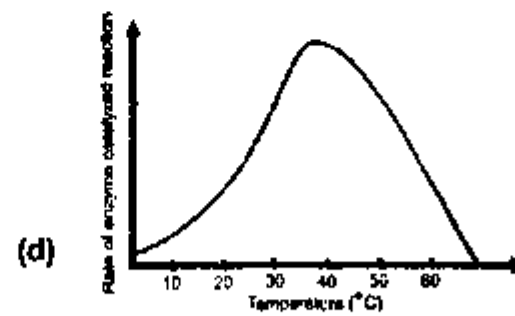
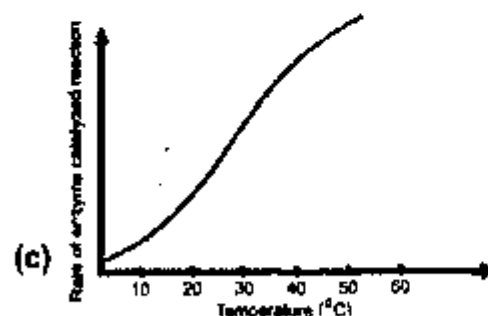
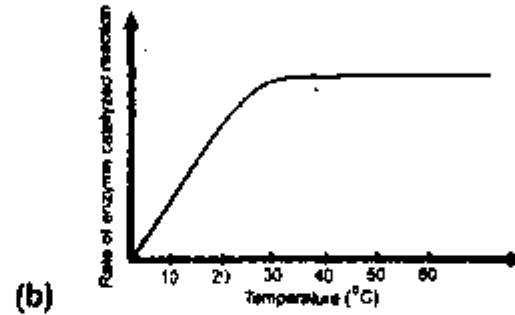
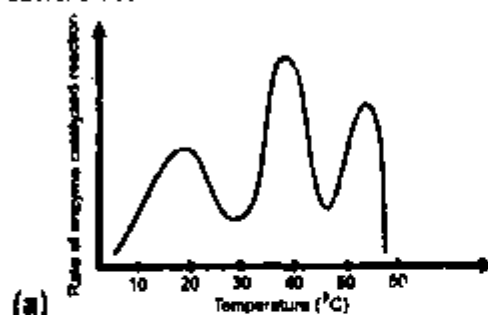
vii. Collective term for all the biochemical reactions that occur in living organisms in order to maintain life is

Chapter # 06

Enzymes

Guess Papers

- ix. Which of these graphs correctly shows the effect of temperature on the rate of an enzyme-controlled reaction?



- x. The state at which all the active sites of the enzymes are occupied and any more substrate molecules do not find free active sites
- A. Co-factor B. Substrate C. Reactant D. Saturation
- xi. The molecules at the beginning of enzymatic reactions; reactants in enzymatic reactions
- A. Substrate B. Co-factor C. Saturation D. Reactant
- xii. The enzyme that digests starch into disaccharides
- A. Amylase B. Biocatalyst C. Inhibitor D. Anabolism

BIOLOGY SSC-I

Time allowed: 2:40 Hours

Total Marks: 53

NOTE: Answer any six parts from Section 'B' and attempt any five parts from Section-C. Attempt any two questions from Section 'D' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

SECTION-B (Marks 18)

- Q.2 Attempt any SIX parts from the following. All parts carry equal marks. Be brief and to the point. (6 × 3 = 18)
- Define cofactor and coenzyme?
 - What is the main use of enzymes in paper industry?
 - What do you mean by the term metabolism?
 - Describe the events that occur during the Metabolism, anabolism and catabolism.
 - Statement 1: All enzymes are catalysts. Statement 2: All catalysts are enzymes. Which one is correct?
 - Describe the mechanism of enzymes presented by German physiologist Winhelm Kuhne.
 - Why all biochemical catalysts are not proteins?
 - Explain how enzymes are extensively used in different industries for fast chemical reactions?

SECTION-C (Marks 15)

- Q.3 Attempt any FIVE parts from the following. All parts carry equal marks. Be brief and to the point. (5 × 3 = 15)

- (iii) What do you know about anabolism.
- (iv) In a range of 0-35°C, the rate of reaction of an enzyme is proportional to temperature. Above 35°C and below 0°C Enzyme activity slows down and eventually stops. Explain why?
- (v) How does pH affect enzyme activity?
- (vi) What characteristic of enzymes makes them specific for substrates?
- (vii) Differentiate between Optimum pH and Optimum temperature.

SECTION-D (Marks 20)

Note: Attempt any TWO questions. All questions carry equal marks. (2 × 10 = 20)

- Q.4 (a) How would you define enzymes? Describe their characteristics.
- b. What do you mean by activation energy and why it is referred in the definition of enzymes?
- Q.5 Briefly describe the factors that affect the activity of enzymes.
- Q.6 Describe the lock and key mechanism of enzyme action.

SOLUTION OF GUESS PAPER & MODEL PAPER # 6 (Reduced Syllabus)

SECTION- A (MCQs)

i. B	ii. D	iii. B	iv. D	v. A	vi. A
vii. C	viii. A	ix. D	x. D	xi. A	xii. A

SECTION-B (Marks 18)

Time allowed: 2:40 Hours

Total Marks: 53

NOTE: Answer any six parts from Section 'B' and attempt any five parts from Section-C. Attempt any two questions from Section 'D' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

- Q.2 Attempt any SIX parts from the following. All parts carry equal marks. Be brief and to the point. (6 × 3 = 18)

- (i) Define cofactor and coenzyme?

Ans: Coenzyme:

The organic cofactors of enzymes that are loosely attached with enzyme; transport chemical groups from one enzyme to another

Cofactor:

The non-protein molecules or ions required by enzymes for activity e.g., metal ions and organic molecules.

- (ii) What is the main use of enzymes in paper industry?

Ans: Paper industry: Enzymes break starch to lower its viscosity that aids in making paper.

- (iii) What do you mean by the term metabolism?

Ans: The term metabolism is derived from a Greek word meaning "change". The concept of metabolism was first of all given by Ibn-e-Nafees, who stated that "the body and its parts are always undergoing change".

Metabolism:

Collective term for all the biochemical reactions that occur in living organisms in order to maintain life.

- (iv) Describe the events that occur during the Metabolism, anabolism and catabolism.

OR

Describe the significance of Metabolism, anabolism and catabolism.

Metabolism is the set of biochemical reactions that occur in living organisms in order to maintain life. These processes allow organisms to grow and reproduce, maintain their structures, and respond to their environments.

During metabolism, chemicals are transformed from one form to the other by enzymes. Enzymes are crucial to metabolism because they act as biocatalysts and speed up and regulate metabolic pathways.

Anabolism:

The chemical reactions in living organisms involved in the synthesis of compounds.

Anabolism includes the biochemical reactions in which larger molecules are synthesized while catabolism includes the biochemical reactions in which larger molecules are broken down.

Catabolism:

Catabolism is the series of chemical reactions that breakdown larger molecules. Usually, energy is released in catabolism and it is utilized in anabolism. In this way, the biochemical reactions are actually energy transfers.

(v) Statement 1: All enzymes are catalysts. Statement 2: All catalysts are enzymes. Which one is correct?

Ans: Statement 1.

(vi) Describe the mechanism of enzymes presented by German physiologist Winhelm Kuhne.

Ans: In 1878, German physiologist Winhelm Kuhne first used the term enzyme. Enzymes are globular proteins. Like all proteins, enzymes are made of long, linear chains of amino acids that fold to produce a three-dimensional molecule.

(vii) Why all biochemical catalysts are not proteins?

Ans: All biochemical catalysts are not proteins, for example RNA molecules also catalyze reactions.

(viii) Explain how enzymes are extensively used in different industries for fast chemical reactions?

OR

Write down the industrial uses of enzymes?

Ans: Uses of enzymes: Enzymes are extensively used in different industries for fast chemical reactions. For example;

1. **Food industry:**

Enzymes that break starch into simple sugars are used in the production of white bread, buns etc.

2. **Brewing industry:**

Enzymes break starch and proteins. The products are used by yeast for fermentation (to produce alcohol).

3. **Paper industry:**

Enzymes break starch to lower its viscosity that aids in making paper.

4. **Biological detergent:**

Protease enzymes are used for the removal of protein stains from clothes. Amylase enzymes are used in dish washing to remove resistant starch residues.

SECTION-C (Marks 15)

Q.3 Attempt any FIVE parts from the following. All parts carry equal marks. Be brief and to the point.

(5 × 3 = 15)

(I) Birds have higher body temperature than mammals. What would happen to the activity of a bird's enzyme if It Is given temperature of 37°C?

Ans: Reaction will slow down.

i) What is the Optimum temperature for human body?

Ans: The optimum temperature for the maximum working speed of human enzymes is 37°C.

ii) What do you know about anabolism.

Ans: Anabolism:

Chapter # 06

Enzymes

Guess Papers

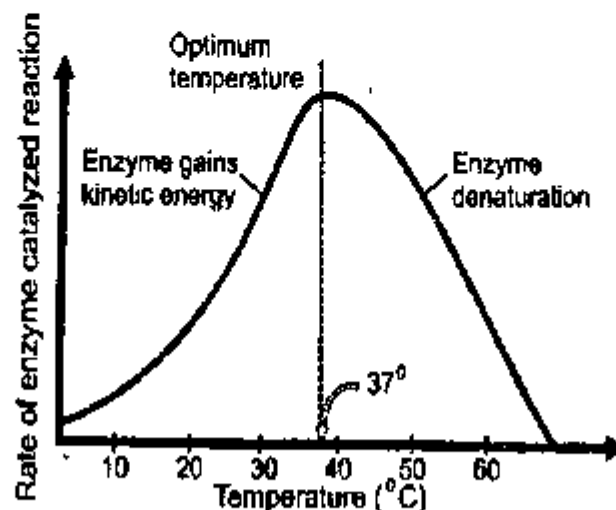
- (iv) In a range of $0-35^{\circ}\text{C}$, the rate of reaction of an enzyme is proportional to temperature. Above 35°C and below 0°C Enzyme activity slows down and eventually stops. Explain why?

Ans: Temperature:

Increase in temperature speeds up the rate of enzyme catalyzed reactions, but only to a point (Figure).

Optimum Temperature:

Every enzyme works at its maximum rate at a specific temperature called as the optimum temperature for that enzyme.



Effect of temperature on enzyme activity

When temperature rises to a certain limit, heat adds in the activation energy and also provides kinetic energy for the reaction. So reactions are accelerated.

Denaturation of Enzyme:

When temperature is raised well above the optimum temperature, heat energy increases the vibrations of atoms of enzyme and the globular structure of enzyme is lost. This is known as the denaturation of enzyme. It results in a rapid decrease in rate of enzyme action and it may be blocked completely.

Conclusion: Thus above 35°C and below 0°C Enzyme activity slows down and eventually stops.

- (v) How does pH affect enzyme activity?

Ans: pH:

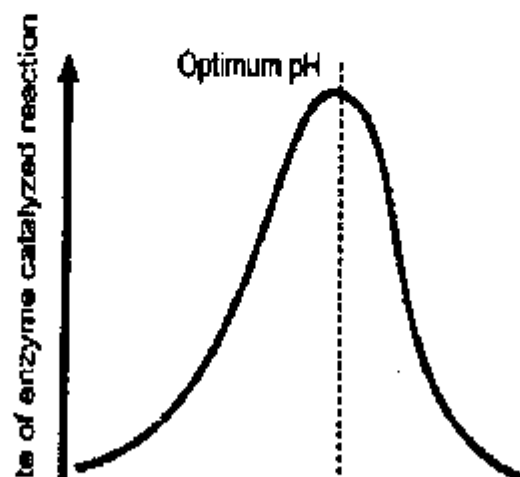
All enzymes work at their maximum rate at a narrow range of pH, called as the optimum pH. A slight change (increase or decrease) in this pH causes retardation in enzyme activity or blocks it completely.

Every enzyme has its specific optimum pH value

For example:

Pepsin (working in stomach) is active in acidic medium (low pH) while trypsin (working in small intestine) shows its activity in alkaline medium (high pH).

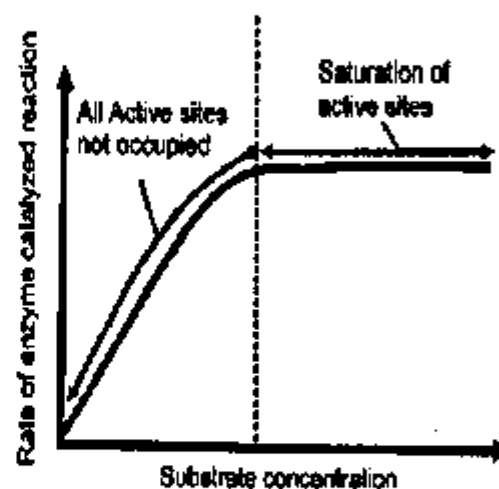
Change in pH can affect the ionization of the amino acids at the active site.



(vi) What characteristic of enzymes makes them specific for substrates?

Ans: Substrate concentration:

If enzyme molecules are available in a reaction, increase in substrate concentration increases the rate of reaction. If enzyme concentration is kept constant and amount of substrate is increased, a point is reached where any further increase in substrate does not increase the rate of reaction any more. When the active sites of all enzymes are occupied (at high substrate concentration), any more substrate molecules do not find free active sites. This state is called **saturation of active sites** and reaction rate does not increase (Figure).



Effect of substrate concentration on enzyme activity

(vii) Differentiate between Optimum pH and Optimum temperature.

Ans: Optimum pH: The pH at which an enzyme works at its maximum rate.

Optimum temperature: The temperature at which an enzyme works at its maximum rate.

SECTION-D (Marks 20)

Note: Attempt any TWO questions. All questions carry equal marks.

(2 × 10 = 20)

Q.4 (a) How would you define enzymes? Describe their characteristics.

Ans: Enzymes:

Proteins which speed of chemical reactions inside living organisms, by minimizing the activation energy are known as enzymes.

Functions of Enzymes:

Enzymes are proteins that catalyze (i.e. speed up) biochemical reactions and are not changed during the reaction. The molecules at which enzymes act are called **substrates**, and enzyme converts them into different molecules, called **products**.

Characteristics of Enzymes:

- i. Almost all enzymes are proteins i.e. they are made of amino acids.
 - ii. Most enzyme reaction rates are millions of times faster than those of comparable uncatalyzed reactions. As with all catalysts, enzymes are not consumed by the reactions they catalyze.
 - iii. Enzymes are usually very specific for the type of reaction and for the nature of their substrates.
 - iv. Only a small portion of enzyme molecule is directly involved in catalysis. This catalytic region is known as active site. It recognizes and binds substrate and then carries out reaction.
 - v. Enzyme production can be enhanced or diminished by a cell according to needs. Enzyme activity can also be regulated by inhibitors and activators.
 - vi. Some enzymes do not need any additional component to work. However, others require non-protein molecules or ions called **cofactors**. Cofactors can be either inorganic (e.g. metal ions) or organic (e.g. flavin and heme). If organic cofactors are tightly bound to enzyme, they are called **prosthetic groups**. If organic cofactors are loosely attached with enzyme, they are called **coenzymes**. Coenzymes transport chemical groups from one enzyme to another. Some important vitamins (e.g. riboflavin, thiamine and folic acid) act as coenzymes.
 - vii. Several enzymes can work together in a specific order, creating **metabolic pathways**. In a metabolic pathway, one enzyme takes the product of another enzyme as a substrate. After the reaction, the product is passed on to the next enzyme.
- b. What do you mean by activation energy and why it is referred in the definition of

Significance of Activation Energy:

All chemical reactions require activation energy. It is defined as minimum energy required to start a reaction. The need for activation energy acts as a barrier to the beginning of reaction (as symbolized in the diagram).

Reference of Activation Energy in Enzymes:

Enzymes lower such barriers by decreasing the requirement of activation energy. Thus, in the presence of enzymes, reactions proceed at a faster rate (Figure).

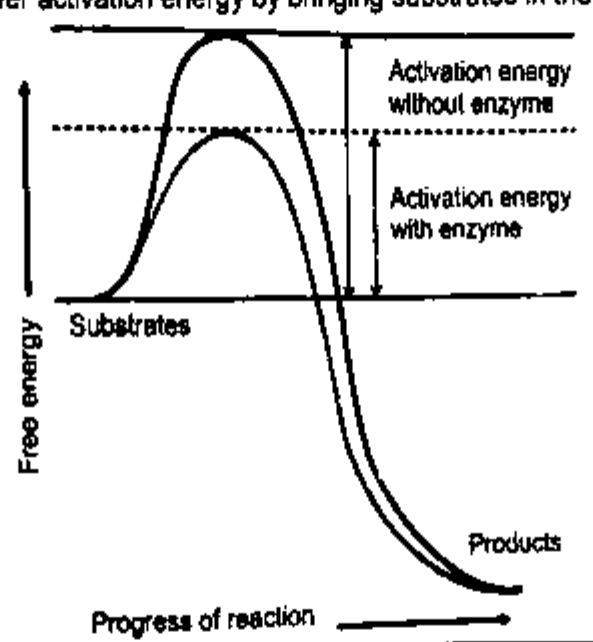


Concept of activation energy

Enzymes lower the activation energy:

Enzymes lower the activation energy in several ways.

- They may alter the shape of substrate and reduce the requirement of energy for this change.
- Some enzymes do so by disrupting the charge distribution on substrates.
- Enzymes may also lower activation energy by bringing substrates in the correct orientation to react.



Enzymes lower the activation energy

Types of Enzymes:

Enzymes can be categorized on the basis of the site where they work i.e. they may be intracellular enzymes (e.g. enzymes of glycolysis working in the cytoplasm) or may be extracellular enzymes (e.g. pepsin enzyme working in the stomach cavity).

Q.5 Briefly describe the factors that affect the activity of enzymes.

Ans: Factors Affecting the Rate of Enzyme Action:

Enzymes are very sensitive to the environment in which they work. Any factor that can change the chemistry or shape of enzyme molecule, can affect its activity.

Some of the factors that can affect the rate of enzyme action are being discussed next.

i. Temperature:

Increase in temperature speeds up the rate of enzyme catalyzed reactions, but only to a point (Figure).

Optimum Temperature:

Every enzyme works at its maximum rate at a specific temperature called as the optimum temperature for that enzyme. When temperature rises to a certain limit, heat adds in the activation energy and also provides kinetic energy for the reaction. So reactions are accelerated.

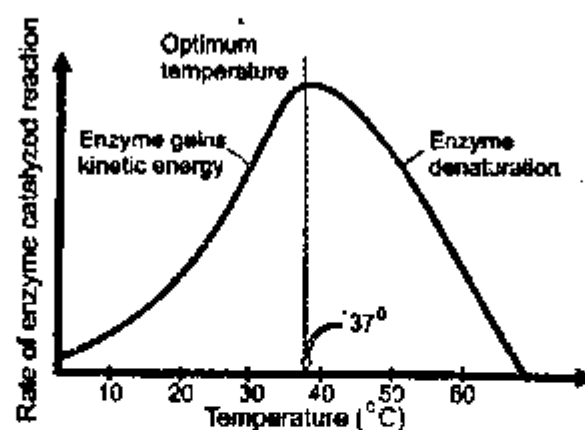
Denaturation of Enzyme:

When temperature is raised well above the optimum temperature, heat energy increases the vibrations

Chapter # 06

Enzymes

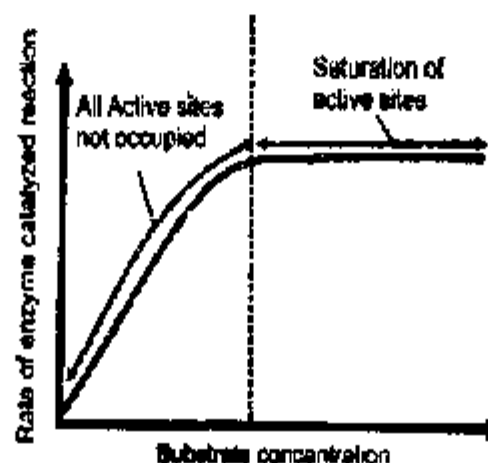
Guess Papers



Effect of temperature on enzyme activity

ii. Substrate concentration:

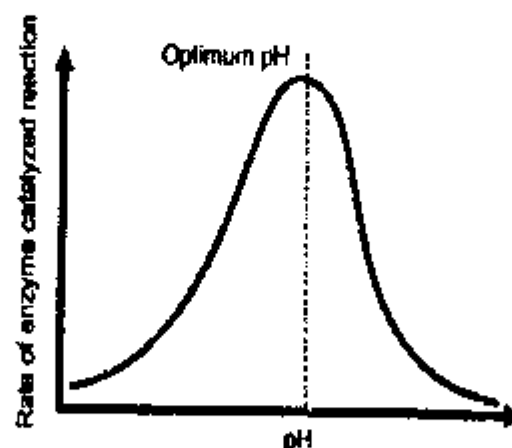
If enzyme molecules are available in a reaction, increase in substrate concentration increases the rate of reaction. If enzyme concentration is kept constant and amount of substrate is increased, a point is reached where any further increase in substrate does not increase the rate of reaction any more. When the active sites of all enzymes are occupied (at high substrate concentration), any more substrate molecules do not find free active sites. This state is called saturation of active sites and reaction rate does not increase (Figure).



iii. pH: All enzymes work at their maximum rate at a narrow range of pH, called as the optimum pH.

A slight change (increase or decrease) in this pH causes retardation in enzyme activity or blocks it completely. Every enzyme has its specific optimum pH value.

For example: Pepsin (working in stomach) is active in acidic medium (low pH) while trypsin (working in small intestine) shows its activity in alkaline medium (high pH).
Change in pH can affect the ionization of the amino acids at the active site.



Effect of pH on enzyme activity

Chapter # 7

Bioenergetics

Topics Included:

- Oxidation and Reduction Reactions (118)
- ATP- The Cell's Energy Currency (119-120)
- Photosynthesis (120)
- Mechanism of Photosynthesis (121-122)
- Respiration (130)
- Aerobic and Anaerobic Respiration (130-131) (Importance of Fermentation excluded)
- Mechanism of Respiration (132)

GUESS PAPER & MODEL PAPER # 7 BASED ON CHAPTER # 7 (Reduced Syllabus) BIOENERGETICS

BIOLOGY SSC-I SECTION-A

Time allowed: 20 Minutes

Marks: 12

NOTE:- Section-A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 20 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q.1 Encircle the correct option i.e. A / B / C / D. All parts carry equal marks.

- In which of the following steps of respiration CO_2 is produced?
A. Glycolysis
B. Krebs cycle
C. Electron transport chain
D. All of these
- Oxygen takes part in aerobic respiration in;
A. Glycolysis
B. Krebs cycle
C. Link step between glycolysis and Krebs cycle
D. Electron transport chain
- When a plant was kept in darkness for many days its leaves turned yellow. Why?
A. Leaves could not get oxygen and so there was no photosynthesis
B. Leaves could not get light and so there was no respiration
C. Leaves could not get oxygen and so there was no respiration
D. Leaves could not get light and so there was no photosynthesis
- From which bonds of ATP molecule energy is taken?
A. P-P bonds
B. C-H bonds
C. C-N bonds
D. C-O bonds
- In which component of the leaf cells, chlorophyll is present?
A. Stroma
B. Thylakoids
C. Plasma membrane
D. Cytoplasm
- Which of these can enter into Krebs cycle?
A. Glucose
B. Pyruvic acid
C. Citric acid
D. Acetyl Co-A
- When we work hard we suffer from muscle fatigue because muscle cells;
A. Carry out aerobic respiration at faster rate and produce lactic acid

Chapter # 07

Bioenergetics

Guess Papers

- viii. How many molecules of CO_2 are produced when Krebs cycle operates once?
A. 01 B. 02 C. 0 D. 06
- ix. In which of the following metabolic processes, oxidation as well as reduction of molecules occur?
A. Photosynthesis B. Respiration C. Both A & B D. None of these
- x. Chlorophyll pigment absorbs maximum light in wavelengths of;
A. Green and blue B. Green and red C. Green only D. Red and blue
- xi. The part of chloroplast; site of the reactions of Calvin cycle:
A. Chlorophyll B. Starch C. Stroma D. Mesophyll
- xii. The flow chart showing the light reactions of photosynthesis:
A. Z-scheme B. Light Reaction C. Photolysis D. Photosystem

BIOLOGY SSC-I

Time allowed: 2:40 Hours

Total Marks: 53

NOTE: Answer any six parts from Section 'B' and attempt any five parts from Section-C. Attempt any two questions from Section 'D' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

SECTION-B (Marks 18)

- Q.2 Attempt any SIX parts from the following. All parts carry equal marks. Be brief and to the point. (6 × 3 = 18)
- (i) Why is it said that all life forms are dependent on photosynthesis?
 - (ii) What structures and phenomena are involved in the intake of carbon dioxide and water by plants?
 - (iii) In what ways the respiratory energy is used in the body of organisms?
 - (iv) What is the importance of anaerobic respiration?
 - (v) Draw a comparison of aerobic and anaerobic respiration.
 - (vi) How will you compare respiration and photosynthesis?
 - (vii) What is meant by Photosynthesis?
 - (viii) Why ATP is called the Cell's Energy Currency?

SECTION-C (Marks 15)

- Q.3 Attempt any FIVE parts from the following. All parts carry equal marks. Be brief and to the point. (5 × 3 = 15)
- (i) What is NADP^+ ?
 - (ii) There are more chloroplasts in the palisade mesophyll than in the spongy mesophyll. Why?
 - (iii) Define and explain aerobic and anaerobic respiration?
 - (iv) Describe the types of anaerobic respiration.
 - (v) Why it is incorrect to say that the energy releasing step of respiration is electron transport chain?
 - (vi) Define Osmosis?
 - (vii) How FAD reduces to FADH_2 ?

SECTION-D (Marks 20)

Note: Attempt any TWO questions. All questions carry equal marks. (2 × 10 = 20)

- Q.4 How would you define bioenergetics while relating it to the Oxidation-reduction reactions in living systems?
- Q.5 Interpret that ATP is the chief energy currency of all cells.

SOLUTION OF GUESS PAPER & MODEL PAPER # 7 (Reduced Syllabus)

SECTION- A (MCQs)

i. B	ii. D	iii. D	iv. A	v. B	vi. D
vii. C	viii. B	ix. C	x. B	xi. C	xii. A

SECTION-B (Marks 18)

Time allowed: 2:40 Hours

Total Marks: 53

NOTE: Answer any six parts from Section 'B' and attempt any five parts from Section-C. Attempt any two questions from Section 'D' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

Q.2 Attempt any SIX parts from the following. All parts carry equal marks. Be brief and to the point. (6 × 3 = 18)

(i) Why is it said that all life forms are dependent on photosynthesis?

Ans: All Life Forms are Dependent on Photosynthesis:

Photosynthesis is the synthesis of glucose from carbon dioxide and water in the presence of sunlight and chlorophyll, with oxygen as a by-product.

Photosynthesis is an anabolic (building) process and is an important component of bioenergetics in living systems.

It is the most important biochemical pathway and nearly all life depends on it. It comprises many coordinated biochemical reactions that occur in plants, some protists (algae), and some bacteria.

(ii) What structures and phenomena are involved in the intake of carbon dioxide and water by plants?

Ans: Intake of Water and Carbon dioxide:

Water and carbon dioxide are the raw materials of photosynthesis. Plants have mechanisms for the intake and transport of these raw materials.

Water, present in soil, is absorbed by roots and root hairs through osmosis. This water is eventually transported to leaves through xylem vessels.

Recalling: Osmosis is the movement of water from a dilute solution to the concentrated one, through a membrane.

The air that enters leaf through tiny pores (stomata) reaches into the air spaces present around mesophyll cells. This air carries CO₂, which gets absorbed in the thin layer of water surrounding mesophyll cells. From here, the carbon dioxide diffuses into mesophyll cells.

Stomata cover only 1-2% of the leaf surface but they allow much air to pass through them.

(iii) In what ways the respiratory energy is used in the body of organisms?

Ans: Bond energy transformed into chemical energy of ATP.

The major energy currency of all cells is a nucleotide called adenosine triphosphate (ATP). It is the main energy source for majority of the cellular functions used in synthesis of macromolecules (DNA, RNA, and proteins), movement, transmission of nerve impulses, active transport, exocytosis and endocytosis etc.

(iv) What is the importance of anaerobic respiration?

Ans: Importance of anaerobic respiration:

Chapter # 07

Bioenergetics

Guess Papers

(v) Draw a comparison of aerobic and anaerobic respiration.

Ans: Difference between aerobic and anaerobic respiration:

Properties	Aerobic respiration	Anaerobic respiration
Presence of Oxygen	Yes	No
Number of ATP as net profit	36	2
Final products	CO ₂ , H ₂ O	Lactic acid or Ethanol + CO ₂
Site of occurrence	Glycolysis in cytoplasm and Krebs cycle and electron transport chain in mitochondria	In cytoplasm
Importance	Major source of energy for most organisms	<ul style="list-style-type: none">• Source of energy for anaerobic organisms• Source of energy for aerobic organisms in short supply of O₂• Source of many products (ethanol, cheese etc)

(vi) How will you compare respiration and photosynthesis?

Ans: Difference between photosynthesis and respiration:

Characteristics	Photosynthesis	Respiration
Metabolism	Anabolism	Catabolism
Energy investment / production	Investment of light energy to store it in the form of bond energy	Bond energy transformed into chemical energy of ATP
Organisms capable of;	Some bacteria, all algae all plants	All organisms
Site of occurrence	Chloroplasts	In cytoplasm and mitochondria
Time of occurrence	In daytime only, in the presence of light	All the time

(vii) What is meant by Photosynthesis?

Ans: Photosynthesis:

Photosynthesis is the synthesis of glucose from carbon dioxide and water in the presence of sunlight and chlorophyll, with oxygen as a by-product. Photosynthesis is an anabolic (building) process and is an important component of bioenergetics in living systems.

It is the most important biochemical pathway and nearly all life depends on it. It comprises many coordinated biochemical reactions that occur in plants, some protists (algae), and some bacteria. A simple general equation for photosynthesis is as follows:



(viii) Why ATP is called the Cell's Energy Currency?

Ans: When cells use energy to build ATP from ADP or ADP from AMP, they are really storing energy as we put money in a bank. Because ATP plays a central role as energy currency in all organisms it must have appeared in the early history of life.

SECTION-C (Marks 15)

Q.3 Attempt any FIVE parts from the following. All parts carry equal marks. Be brief and to the point. (5 × 3 = 15)

(i) What is NADP⁺?

Ans: NADP⁺:

Nicotinamide adenine dinucleotide (NAD⁺) is a coenzyme that takes electrons and hydrogen ions and is thus reduced to NADH. One form of this coenzyme also carries phosphate with it, so is called NADP⁺.

(iii) Define and explain aerobic and anaerobic respiration?

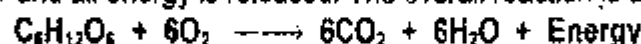
Ans: **Aerobic and Anaerobic Respiration:**

The cellular respiration occurring in the presence of oxygen is called aerobic respiration while the one that occurs in the absence of oxygen is called anaerobic respiration.

i. **Aerobic Respiration:**

In the presence of oxygen, complete oxidation of glucose occurs with maximum release of energy.

In the first phase of aerobic respiration, a molecule of glucose (6-C) is broken down into two molecules of pyruvic acid (3-C). In the second phase, molecules of pyruvic acid are completely oxidized (all C-H bonds are broken) to CO_2 and water and all energy is released. The overall reaction is as follows.



ii. **Anaerobic Respiration (Fermentation):**

In the absence of oxygen, glucose is incompletely oxidized with less amount of energy released. In anaerobic respiration, the first phase is exactly similar to that of aerobic respiration. A molecule of glucose is broken down into two molecules of pyruvic acid. But in the second phase, pyruvic acid is not completely oxidized (due to the absence of oxygen). It is transformed into ethyl alcohol or lactic acid. In this way many of the C-H bonds are left unbroken in the products. Anaerobic respiration is further classified as alcoholic fermentation and lactic acid fermentation.

(iv) Describe the types of anaerobic respiration.

Ans: **Types of anaerobic respiration:**

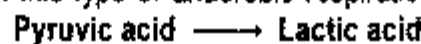
A- **Alcoholic fermentation:**

It occurs in bacteria, yeast etc. In this type of anaerobic respiration, pyruvic acid is further broken down into alcohol ($\text{C}_2\text{H}_5\text{OH}$) and CO_2 .



B- **Lactic acid fermentation:**

It occurs in skeletal muscles of humans and other animals during extreme physical activities. This also happens in the bacteria present in milk. In this type of anaerobic respiration, each pyruvic acid molecule is converted into lactic acid ($\text{C}_2\text{H}_5\text{O}_3$).



(v) Why it is incorrect to say that the energy releasing step of respiration is electron transport chain?

Ans: Energy is released in glycolysis and Krebs cycle in the form of NADH and FADH_2 . Electron transport chain transforms the energy present in these compounds to ATP.

(vi) Define Osmosis?

Ans: **Osmosis:**

Osmosis is the movement of water from a dilute solution to the concentrated one, through a membrane.

(vii) How FAD reduces to FADH_2 ?

Ans: Flavin adenine dinucleotide (FAD) is also a coenzyme like NAD^+ . It gets 2 hydrogen and reduces to FADH_2 .

SECTION-D (Marks 20)

Note: Attempt any TWO questions. All questions carry equal marks.

(2 × 10 = 20)

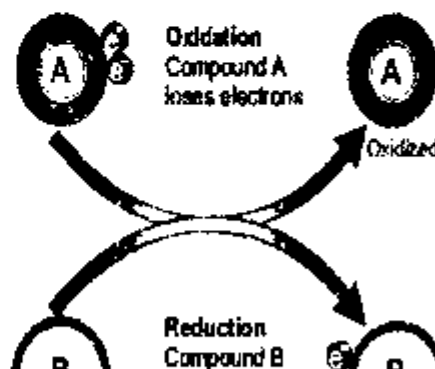
Q.4 How would you define bioenergetics while relating it to the Oxidation-reduction reactions in living systems?

Ans: **Bioenergetics:**

Bioenergetics is the study of energy relationships and energy transformations (conversions) in living organisms.

Oxidation-Reduction Reactions:

Various life processes in organisms involve constant flow of energy. This energy flow comprises the acquisition, transformation and use of energy for various life processes like growth, movement, reproduction etc.



Reduction: The gain of electrons is called reduction.

Role of Electrons in Bioenergetics:

Electrons can be an energy source. It depends upon their location and arrangement in atoms. For example; when they are present in oxygen, they make stable association with oxygen atom and are not good energy source. But if electrons are dragged away from oxygen and attached to some other atom e.g. carbon or hydrogen, they make unstable association.

They try to move back to oxygen and when this happens, energy is released.

Role of Redox Reactions:

In living organisms redox reactions involve the loss and gain of hydrogen atoms. We know that a hydrogen atom contains one proton and one electron. It means that when a molecule loses a hydrogen atom, it actually loses an electron (oxidation) and similarly when a molecule gains hydrogen atom, it actually gains an electron (reduction).

Q.5 Interpret that ATP is the chief energy currency of all cells.

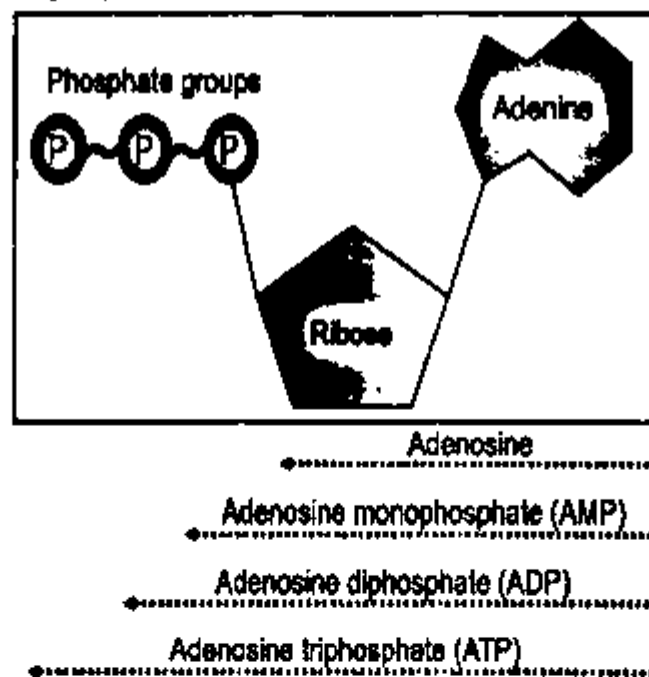
Ans: ATP the Cell's Energy Currency:

ATP was discovered in 1929 by Karl Lohmann, and was proposed to be the main energy-transfer molecule in the cell by the Nobel prize winner, Fritz Lipmann in 1941.

The major energy currency of all cells is a nucleotide called adenosine triphosphate (ATP). It is the main energy source for majority of the cellular functions like synthesis of macromolecules (DNA, RNA, and proteins), movement, transmission of nerve impulses, active transport, exocytosis and endocytosis etc.

The ability of ATP to store and release energy is due to its molecular structure. Figure shows a simplified diagram of ATP. Each ATP molecule has three subunits:

- (a) adenine - a double-ringed nitrogenous base;
- (b) a ribose - a five-carbon sugar;
- (c) three phosphate groups in a linear chain.



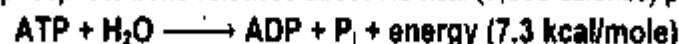
Molecular structure of ATP

ATP Transfers Energy between Metabolic Reactions:

The covalent bond connecting two phosphates is indicated by the "tilde" (~) and it is a high-energy bond. The energy in this bond is released as it breaks and inorganic phosphate (P_i) gets separated from ATP.

Energy Released by breaking of one phosphate bond:

The breaking of one phosphate bond releases about 7.3 kcal (7,300 calories) per mole of ATP as follows:



In common energy reactions only the outermost of the two high-energy bonds breaks. When this

Chapter # 07

Bioenergetics

Guess Papers

The synthesis of ATP from ADP and P_i requires the expenditure of 7.3 kcal of energy per mole. This energy is obtained from the oxidation of foodstuff. So we can summarize that ATP is generated by energy-releasing processes and is broken down by energy-consuming processes. In this way ATP transfers energy between metabolic reactions.

When cells use energy to build ATP from ADP, or ADP from AMP, they are really storing energy as we put money in a bank

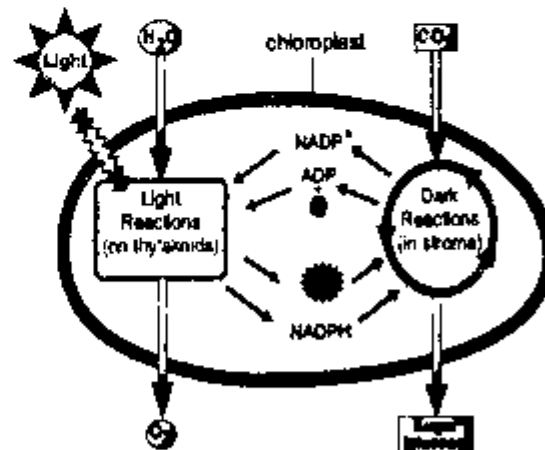
Q.6 (a) Outline the processes involved in photosynthesis?

Ans: Mechanism of Photosynthesis:

Photosynthesis occurs in two phases.

First Phase of Photosynthesis (Light Reactions):

During first phase, light energy is captured and is used to make high-energy molecules (ATP and NADPH). These reactions, which are known as light reactions, take place on the thylakoid membranes of chloroplasts.



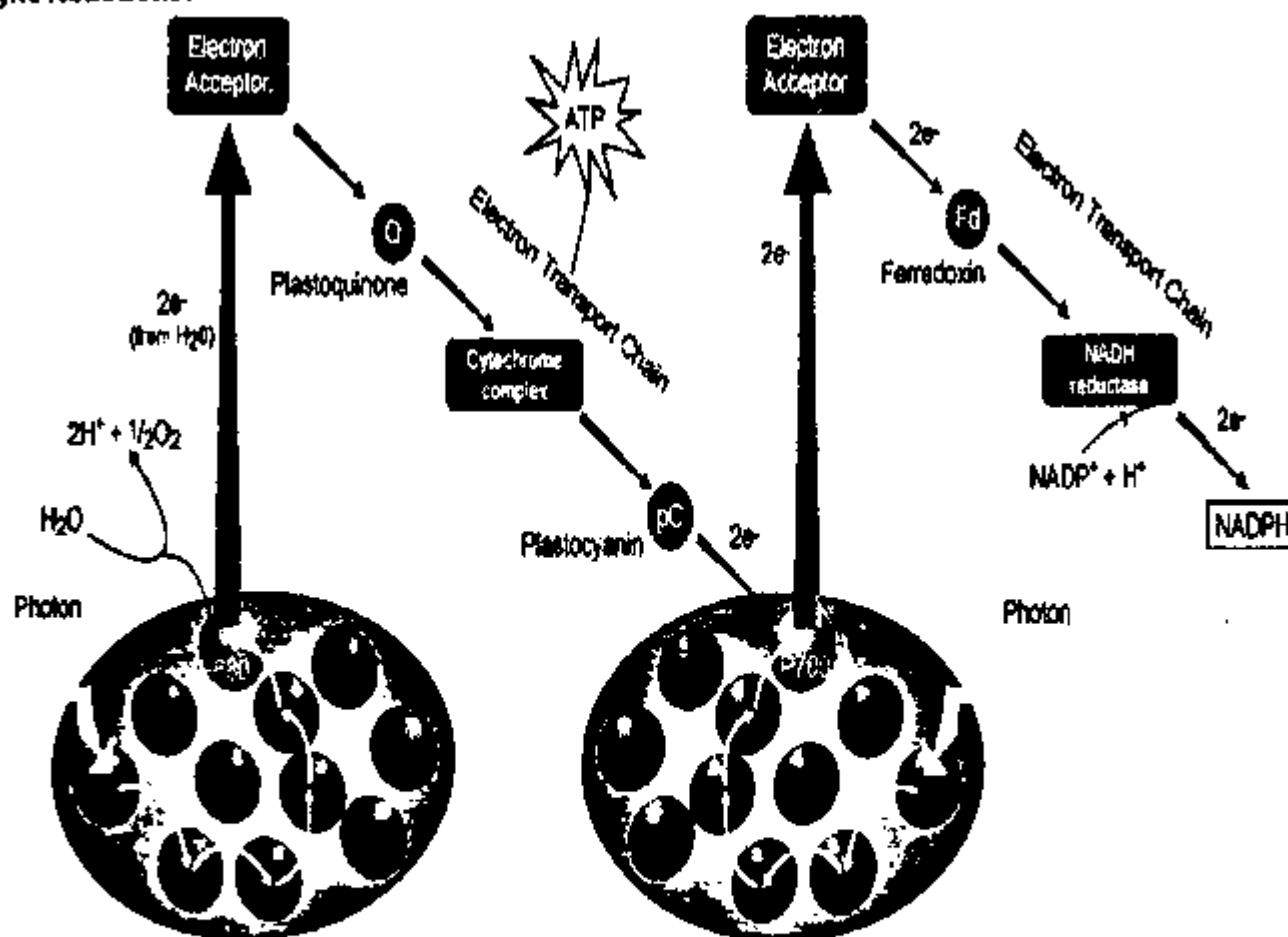
Summary of photosynthesis

Second Phase of Photosynthesis (Dark Reactions):

During second phase, carbon dioxide is reduced to make glucose. In this phase, the energy from high energy molecules (ATP and NADPH) is utilized. Since these reactions do not use light directly, they are known as dark reactions. The dark reactions take place in the stroma of the chloroplasts.

Nicotinamide adenine dinucleotide (NAD^+) is a coenzyme that takes electrons and hydrogen ions and is thus reduced to NADH. One form of this coenzyme also carries phosphate with it, so is called $NADP^+$.

Light Reactions:



Chapter # 07

Bioenergetics

Guess Papers

The summary of the events of light reactions is as follows;

- When chlorophyll molecules absorb light, their energy level increases and their electrons are emitted.
- Electrons are passed to electron transport chain to produce ATP.
- Light also breaks water molecule (photolysis) and oxygen is released. The hydrogen atoms of water give electrons to chlorophyll and become ions.
- The electrons of chlorophyll, after the production of ATP, and the hydrogen ions of water are used for the reduction of NADP^+ into NADPH.

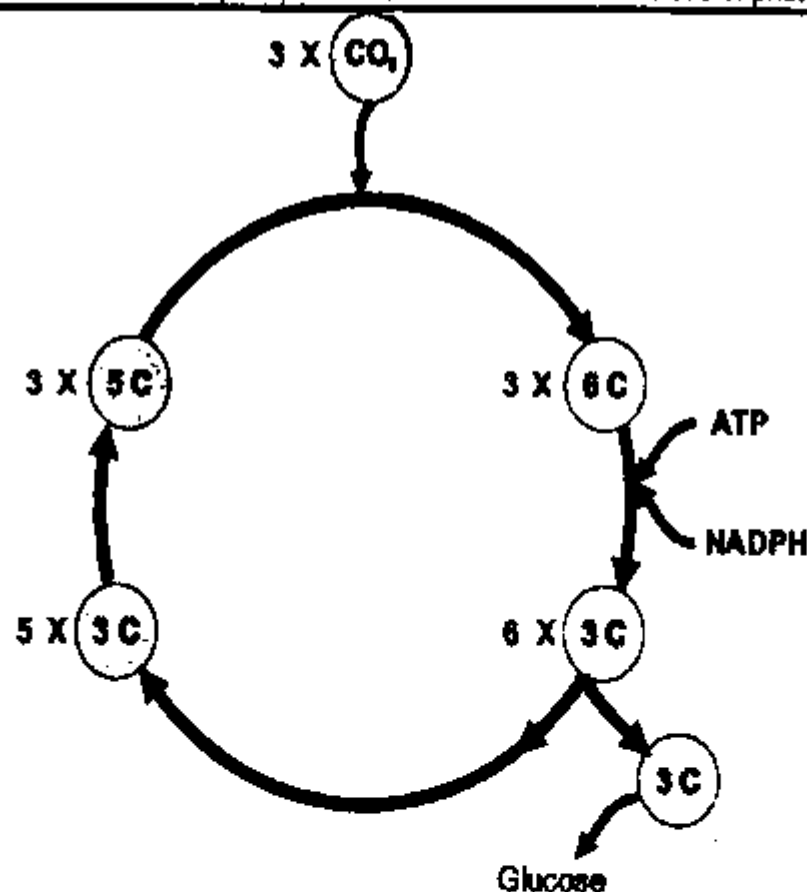
The whole series of light reactions is called Z-scheme due to its Z-shaped flow chart.

Dark Reactions (Calvin Cycle):

The details of dark reactions were discovered by Malvin Calvin and his colleagues at the University of California. The summary of the events of dark reactions, also known as Calvin cycle (Fig) is as follows;

- CO_2 molecules are combined with 5-carbon compounds to form 2 temporary 6-carbon compounds, each of which splits into two 3-carbon compounds.
- The 3-carbon compounds are reduced to 3-carbon carbohydrates by using ATP and hydrogen from NADPH. The 3-carbon carbohydrates are used to manufacture glucose.
- The 3-carbon carbohydrates are also used to regenerate the original 5-carbon compounds. This step also utilizes ATP.

Calvin was awarded Nobel prize, in 1961, for his work on the details of photosynthesis.



Dark reactions of photosynthesis (The Calvin cycle)

- (b) Outline the mechanism of respiration while defining glycolysis, Krebs cycle and electron transport chain.

Ans: See Q3(b). FBISE Paper (2015), Page # 107.

Chapter # 8

Nutrition

Topics Included:

- Components of Human Food (143)
- Minerals (Table 8.2 excluded) (144)
- Role of Calcium and Iron (145)
- Effects of Water and Dietary Fiber (150)
- Digestion In Humans (157-165) (Disorders Excluded)

GUESS PAPER & MODEL PAPER # 8 BASED ON CHAPTER # 8 (Reduced Syllabus) NUTRITION

BIOLOGY SSC-I SECTION-A

Time allowed: 20 Minutes

Marks: 12

NOTE:- Section-A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 20 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q.1 Encircle the correct option i.e. A / B / C / D. All parts carry equal marks.

- What is the primary nutrient that provides quick useable energy for the body?**
A. Carbohydrates B. Proteins C. Lipids D. Nucleic acids
- The wavelike movement of muscle that pushes food through the digestive system is called;**
A. Chemical digestion B. Emulsification C. Absorption D. Peristalsis
- Micronutrients of plants are;**
A. Available in the soil only in small amounts
B. Required by plants in small amounts
C. Small molecules required by plants
D. Useful, but not required by plants
- Which of the following does not occur in the oral cavity?**
A. Lubrication of the food B. Beginning of protein digestion
C. Breaking the food into small fragments
D. All of the above do occur in the oral cavity
- Where are the villi found?**
A. Esophagus B. Stomach
C. Small intestine D. Large intestine
- Ulcer occur in the;**
A. Stomach B. Duodenum C. Esophagus D. All of these
- Which group of enzymes breaks up starches and other carbohydrates?**
A. Proteases B. Lipases C. Amylases D. None of these
- The pancreas produces digestive enzymes and releases them into the;**
A. Colon B. Gallbladder C. Liver D. Duodenum
- In the stomach, pepsinogen is converted into;**

- xi. Which of the following is not a function of the liver?
- | | |
|------------------------------------|---------------------------------|
| A. Converts glucose to glycogen | B. Converts glycogen to glucose |
| C. Detoxifies poisonous substances | D. Produces digestive enzymes |
- xii. The diseases of Kwashiorkor and marasmus may be due to;
- | | |
|--------------------------------|-----------------------------|
| A. Mineral deficiency | B. Over-intake of nutrients |
| C. Protein-energy malnutrition | D. Ulcer |

BIOLOGY SSC-I

Time allowed: 2:40 Hours

Total Marks: 53

NOTE: Answer any six parts from Section 'B' and attempt any five parts from Section-C. Attempt any two questions from Section 'D' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

SECTION-B (Marks 18)

- Q.2 Attempt any SIX parts from the following. All parts carry equal marks. Be brief and to the point. (6 × 3 = 18)
- (i) Discuss the role of different minerals in human.
 - (ii) How will you differentiate between bolus and chyme?
 - (iii) Which sphincters play role in the movement of food in and out of stomach?
 - (iv) Stomach is an organ of the digestive system, but it also secretes a Hormone. What hormone is it and what function it perform?
 - (v) What are the components of human food?
 - (vi) What are carbohydrates? How are carbohydrates important in our diets?
 - (vii) Describe the important functions of Carbohydrates, proteins and lipids?
 - (viii) What are lipids? How are lipids important in our diets?

SECTION-C (Marks 15)

- Q.3 Attempt any FIVE parts from the following. All parts carry equal marks. Be brief and to the point. (5 × 3 = 15)
- (i) Pepsin is a powerful protein-digesting enzyme. Why does not it digest the stomach walls, which are mostly proteins?
 - (ii) How a piece of roti and mutton digest in our body?
 - (iii) Describe the harmful effects of carbonated soft drinks? OR what are the harmful effects of phosphoric acid and caffeine?
 - (iv) What is appendix? Why infected appendix must be removed?
 - (v) Describe the difference between mechanical and chemical digestion?
 - (vi) Describe the reasons why the process of digestion in human is necessary?
 - (vii) What are proteins? How are proteins important in our diets?

SECTION-D (Marks 20)

Note: Attempt any TWO questions. All questions carry equal marks. (2 × 10 = 20)

- Q4. (a) Why are water and dietary fibres considered important in our diets?
(b) Explain the Role of Liver in digestion?

SOLUTION OF GUESS PAPER & MODEL PAPER # 8 (Reduced Syllabus)

SECTION- A (MCQs)

i. A	ii. D	iii. B	iv. B	v. C	vi. D
vii. C	viii. D	ix. A	x. A	xi. D	xii. C

SECTION-B (Marks 18)

Time allowed: 2:40 Hours

Total Marks: 53

NOTE: Answer any six parts from Section 'B' and attempt any five parts from Section-C. Attempt any two questions from Section 'D' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

Q.2 Attempt any SIX parts from the following. All parts carry equal marks. Be brief and to the point. (6 × 3 = 18)

(i) Discuss the role of different minerals in human.

OR

Describe important minerals and their roles in human body?

Ans: Minerals: Minerals are inorganic elements that originate in the Earth and cannot be made in body.

Importance of Minerals:

They play important roles in various body functions and are necessary to maintain health.

Most of the minerals in human diet come directly from plants and water, or indirectly from animal foods.

Types of Minerals: Minerals are categorized into major and trace minerals.

i. **Major minerals:** Major minerals are required in the amounts of 100 mg (milligrams) or more per day.

ii. **Trace minerals:** Trace minerals are required in amounts less than 100 mg per day.

(ii) How will you differentiate between bolus and chyme?

Ans: Bolus: The small, slippery, spherical mass of food formed in the oral cavity during the processes of mastication, lubrication, and semi-digestion.

Chyme: The soup-like mixture formed after the action of stomach on food.

(iii) Which sphincters play role in the movement of food in and out of stomach?

Ans: Stomach has two sphincters (openings which are guarded by muscles). The cardiac sphincter is between stomach and oesophagus while the pyloric sphincter is between stomach and small intestine. The bolus enters the stomach from oesophagus through the cardiac sphincter.

(iv) Stomach is an organ of the digestive system, but it also secretes a Hormone. What hormone is it and what function it perform?

Ans: Entrance of Food in stomach:

When food enters stomach, the gastric glands found in the stomach wall are stimulated to secrete gastric juice. It is composed chiefly of mucous, hydrochloric acid, and a protein-digesting enzyme pepsinogen.

Functions of Hydrochloric acid:

Hydrochloric acid converts the inactive enzyme pepsinogen into its active form called pepsin, HCl also kills microorganisms present in food. Pepsin partially digests the protein portion of the food (bulk of mutton) into polypeptide and ' shorter peptide chains.

(v) What are the components of human food?

Ans: Components of Human Food:

The nutritional requirements of human and other animals are relatively complex as compared to plants. Like other animals, the nutrients used by humans include carbohydrates, lipids, nucleic acids, proteins, minerals, vitamins. Besides these nutrients, they also require water.

Carbohydrates are vital for energy in humans.

Importance of carbohydrate in our diets:

Carbohydrates are the basic source of energy for all animals. About half to 2/3 of the total calories every animal consumes daily are from carbohydrates. Glucose is the most often used carbohydrate for energy.

Other useful carbohydrates are maltose, lactose, sucrose and starch.

Energy value of carbohydrates: Carbohydrates contain 04 kilocalories per gram.

Food sources of carbohydrates:

Humans get carbohydrates from the foods like bread, pastas, beans, potatoes, bran, rice and cereals.

(vii) Describe the important functions of Carbohydrates, proteins and lipids?

Ans: Carbohydrates are the most common source of energy. Proteins and lipids are vital building components for body but they can also be used for energy.

(viii) What are lipids? How are lipids important in our diets?

Ans: Lipids (fats) in Food:

The lipids present in food are composed of fatty acids bonded to glycerol. The fatty acids of lipids may be saturated or unsaturated.

Saturated fatty acids have all of their carbon atoms bonded to hydrogen atoms, whereas **unsaturated fatty acids** have some of their carbon atoms double-bonded in place of a hydrogen atom.

Saturated fatty acids: Generally, the lipids containing saturated fatty acids are solid at room temperature.

Unsaturated fatty acids: The lipids containing unsaturated fatty acids are liquid at room temperature.

For example butter contains nearly 70% saturated and 30% unsaturated fatty acids. Sunflower oil, on the other hand, contains nearly 75% unsaturated fatty acids.

Importance of lipids in our diets:

Lipids are used to form membranes, the sheaths surrounding neurons, and certain hormones. Lipids are also extremely useful energy sources.

Energy value of lipids: One gram of lipids contains 09 kilocalories of energy.

Dietary sources of lipids:

Important sources of lipids include milk, butter, cheese, eggs, mutton, fish, mustard seeds, coconut, and dry fruits etc.

SECTION-C (Marks 15)

Q.3 Attempt any FIVE parts from the following. All parts carry equal marks. Be brief and to the point.
(5 × 3 = 15)

(I) Pepsin is a powerful protein-digesting enzyme. Why does not it digest the stomach walls, which are mostly proteins?

Ans: We saw that pepsin is not released in its active form. Rather it is secreted as inactive pepsinogen, which requires HCl for activation. The mucous of gastric juice forms a thick coating over the inner walls of stomach and neutralizes the HCl there. It makes pepsinogen difficult to be activated and to attack stomach walls.

(II) How a piece of roti and mutton digest in our body?

Ans: When we bite off a piece of roti and mutton, chew it and then swallow it, there is some gastric juice already present in the stomach. Sometimes even the sight of food causes the release of gastric juice. When the bite is in oral cavity, message is conveyed to the brain in the form of nerve impulses. From the brain message is passed to the walls of the stomach for the secretion of some gastric juice. When food touches the walls of the stomach, more gastric juice is secreted. If we eat only a bite of bread, which has little protein in it, the stomach does not secrete more gastric juice.

When we eat mutton, it results in the release of abundant gastric juice. The reason is that when food reaches the stomach the already present gastric juice begins the digestion of any proteins present in it. The huge protein molecules are broken down into peptides. These peptides are further broken down into amino acids.

(iii) Describe the harmful effects of carbonated soft drinks? OR what are the harmful effects of phosphoric acid and caffeine?

Ans: There is a growing concern about the harmful effects of carbonated soft drinks. They are very acidic and make our bodies poor in oxygen. They contain phosphoric acid which dissolves calcium out of the bones. This results in bones weakening. The caffeine present in colas increases the heart rate and raises blood pressure.

(iv) What is appendix? Why infected appendix must be removed?

Ans: Appendix:

A non-functional finger-like process called appendix arises from the blind end of caecum. Inflammation of the appendix due to infection causes severe pain. The infected appendix must be removed surgically otherwise it may burst and the inflammation may spread in abdomen.

(v) Describe the difference between mechanical and chemical digestion?

Ans: Difference between mechanical and chemical digestion:

Mechanical digestion:

Mechanical digestion involves mastication, the use of teeth to tear and crush food, and churning in the stomach.

Chemical digestion:

Chemical digestion involves action of enzymes to break down complex molecules into simple structures. Proteins are digested into their constituent amino acids, polysaccharides are digested into simple sugars (e.g. glucose), and lipids are digested into fatty acids and glycerol.

(vi) Describe the reasons why the process of digestion in human is necessary?

Ans: Importance of the process of digestion in human:

Our cells require oxygen, water, salts, amino acids, simple sugars, fatty acids, and vitamins. These can cross cell membranes to enter cells. Amino acids, simple sugars and fatty acids are rare in our environment. Such substances are usually parts of larger molecules like proteins, polysaccharides and lipids, which cannot cross the membranes. There is a need of converting such large and non-diffusible molecules into smaller and diffusible molecules (that can cross the membranes). This is achieved through the process of digestion.

(vii) What are proteins? How are proteins important in our diets?

Ans: Proteins:

Proteins are composed of amino acids. Proteins are essential components of the cytoplasm, membranes and organelles. They are also the major components of muscles, ligaments, and tendons.

Importance of proteins in our diets:

So we use proteins for growth. Many proteins play role as enzymes. Proteins can also be used for gaining energy.

Energy value of proteins: One gram of proteins contains 04 kilocalories of energy.

Dietary sources of protein:

Dietary sources of proteins are meat, eggs, grains, legumes, and dairy products such as milk and cheese.

SECTION-D (Marks 20)

Note: Attempt any TWO questions. All questions carry equal marks. (2 × 10 = 20)

Q4. (a) Why are water and dietary fibres considered important in our diets?

Ans: Effects of water and dietary fibre:

Strictly speaking, water and dietary fibre are not considered as nutrients, but they do play important role in life.

Water:

Approximately 60% of the adult human body is composed of water. Nearly all life sustaining chemical reactions require an aqueous (watery) environment.

Importance of water in our diets:

1. Water also functions as the environment in which water-soluble foodstuff is absorbed in the intestines

- iii. Severe dehydration may result in cardiovascular problems.
- iv. The estimated water requirement of an average adult is two litres per day.

Sources of water:

Important sources of daily water intake are natural water, milk, juicy fruits and vegetables.

Dietary fibre:

Dietary fibre (also known as "roughage") is the part of human food that is indigestible.

Importance of Dietary fibre in our diets:

- i. It is found only in plant foods and it moves undigested through stomach and small intestine and into colon. The insoluble dietary fibre travels quickly through small intestines.
- ii. The soluble dietary fibre breaks down as it passes through alimentary canal.
- iii. Fibre prevents and relieves constipation by stimulating the contraction of intestinal muscles.
- iv. Avoiding constipation reduces the risk of many other diseases.

Types of dietary fibre: There are two types of dietary fibre, insoluble and soluble.

Soluble fibre: Soluble fibre helps in lowering blood cholesterol and sugar levels.

Insoluble fibre: Insoluble fibre speeds up the movement of carcinogens (cancer causing agents) from intestine.

Sources of fibre: Its sources are wheat bran, cereals and skins of many fruits and vegetables.

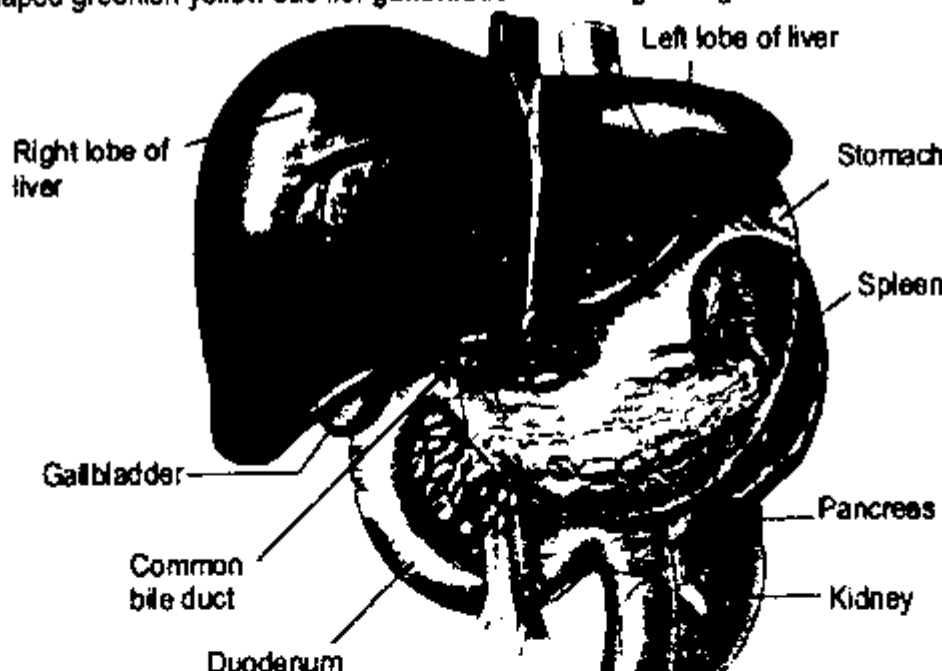
(b) Explain the Role of Liver in digestion?

Ans: Liver:

Liver is the largest gland of body. It is multi-lobed and dark reddish in appearance. It lies beneath the diaphragm on the right side of abdomen. In an adult human, it weighs about 1.5 kg and is the size of a football.

Gallbladder:

A pear-shaped greenish yellow sac i.e. gallbladder lies along the right lobe of liver on ventral side.



Liver and associated organs
Liver and associated organs

Secretion of Liver (Bile):

Liver secretes bile, which is stored in the gallbladder. When the gallbladder contracts the bile is released into the duodenum through the common bile duct. Bile has bile salts which keep lipid droplets separate from one another, a process called emulsification. It helps the lipid-digesting enzymes to attack on lipids.

Role of Liver in digestion/Functions of Liver:

Besides digestion, liver carries out a number of other functions, some of which are summarized here;

- Removes amino groups from amino acids (de-amination)

- Manufactures blood clotting proteins called fibrinogen.
- Converts glucose into glycogen and, when required, breaks glycogen into glucose.
- Converts carbohydrates and proteins into lipids and produces cholesterol.
- Produces heat to maintain body temperature.
- Stores fat-soluble vitamins (A, D, E, and K) and mineral ions, such as iron.

Q5. Describe the structures and functions of the main regions of the alimentary canal.

Ans: Alimentary canal:

The digestive system of human consists of a long tube that extends from the mouth to the anus. This tube is called alimentary canal.

Structure of human alimentary canal:

Main sections of alimentary canal are:

- | | | |
|----------------|---------------------|---------------------|
| i. Oral cavity | ii. Pharynx | iii. Oesophagus |
| iv. Stomach | v. Small intestines | vi. Large intestine |

Glands associated with the alimentary canal:

In addition there are many glands associated with the alimentary canal. These are the three pairs of salivary glands, the pancreas and the liver.

We will go through the structure and functioning of digestive system by assuming how a bite of bread 'roti' taken with some dish (like mutton) is digested and how small molecules like amino acids, simple sugars, fatty acids, vitamins, salts and water are provided to cells.

Oral cavity – (Selection, grinding, partial digestion):

Functions of oral cavity:

1. Food Selection:

Oral cavity is the space behind mouth and has many important functions in the whole process. Food selection is one of them. When food enters the oral cavity, it is tasted and felt. If the taste of mutton suggests that it is old, we reject it. If the teeth or tongue detect some hard object, such as dirt, we also reject that bite. The senses of smell and vision also help oral cavity in the selection of food.

2. Grinding of food:

The second function of oral cavity is the grinding of food by teeth. It is known as chewing or mastication. This is useful first because the esophagus can pass only small pieces and secondly because enzymes cannot act on large pieces of food. They require small pieces with large surface areas to attack.

3. Lubrication and chemical digestion of food:

The third and fourth functions of the oral cavity are the lubrication and chemical digestion of food. The chewing process stimulates the three pairs of salivary glands (under the tongue, behind the jaws, and in front of ears) to release a juice called saliva in oral cavity.

Functions of Saliva:

Saliva has two main functions. First it adds water and mucous to the food which act as lubricant to ease the passage of food through oesophagus. Second, saliva contains an enzyme **salivary amylase**, which aids in the partial digestion of starch.

Bolus:

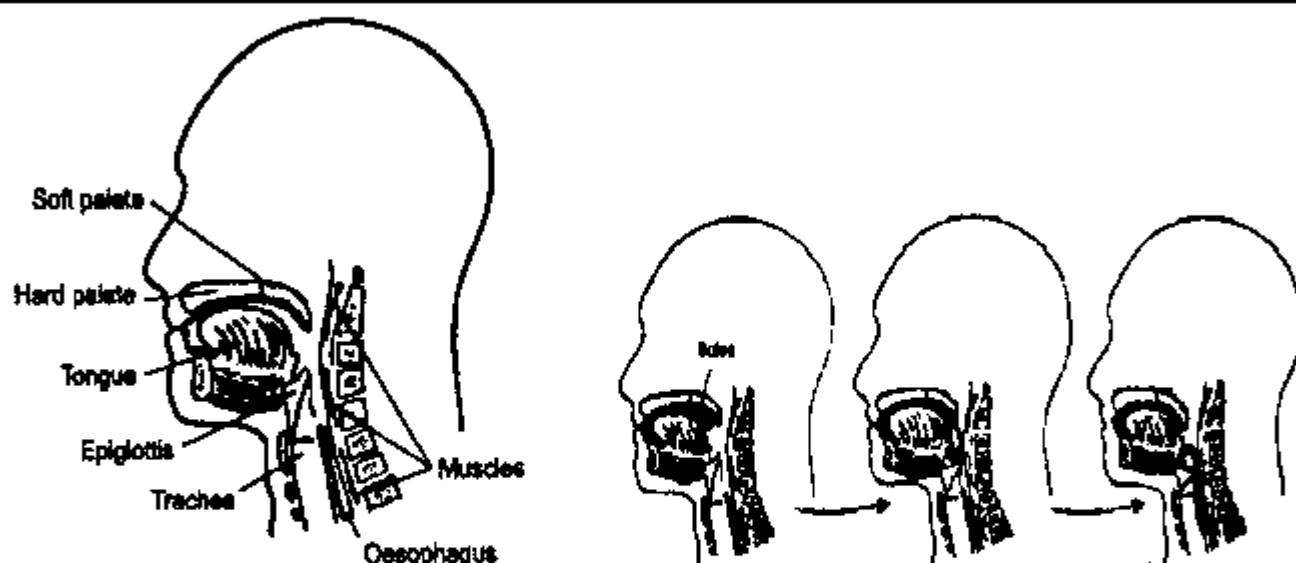
After the processes of chewing, lubrication, and partial digestion the pieces of bread and mutton are rolled up by the tongue into small, slippery, spherical mass called bolus. We swallow the bolus and push it in oesophagus through the pharynx.

Pharynx and Oesophagus – (Swallowing and Peristalsis):

Steps in swallowing:

During swallowing, bolus is pushed to the back of mouth by tongue. When tongue pushes bolus, the soft palate also moves upward and to rear. In this way, the opening of nasal cavity is closed. When swallowed, the bolus passes pharynx to enter oesophagus. Pharynx has adaptations to prevent the entry of bolus particles in trachea (wind pipe to lungs).

During swallowing, larynx (the top of trachea) moves upward and forces the epiglottis (a flap of



Steps in swallowing

After being swallowed, the food enters the tube called the oesophagus, which connects the pharynx to the stomach. Neither the pharynx nor the oesophagus contributes to digestion and the previous digestive actions of saliva continue.

Steps in Peristalsis:

Peristalsis moves the food from the oral cavity to the rectum. Peristalsis is defined as the rhythmic sequence of waves of contraction in the smooth muscles of the walls of alimentary canal, thus squeezing the food down along the alimentary canal.

Stomach – (Digestion, churning, and melting):

The stomach is a dilated part of the alimentary canal. It is J-shaped, located in the left of the abdomen, just beneath the diaphragm.

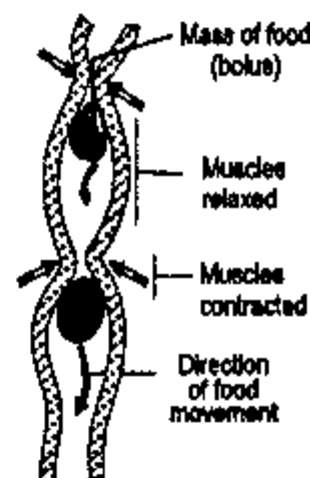
Portions of Stomach: Stomach has two main portions.

i. Cardiac portion:

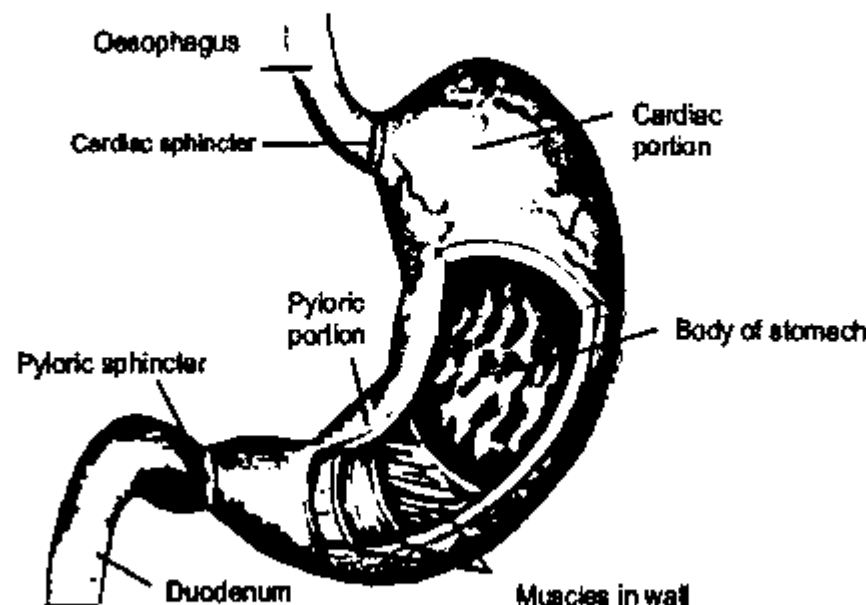
The cardiac portion is present immediately after oesophagus.

ii. Pyloric portion:

The pyloric portion is located beneath the cardiac portion. Stomach has two sphincters (openings which are guarded by muscles).



Peristalsis



Cardiac sphincter and pyloric sphincter:

Cardiac sphincter is between stomach and oesophagus while pyloric sphincter is between stomach and small intestine. Bolus enters stomach from oesophagus through cardiac sphincter.

Entrance of Food in stomach:

When food enters stomach, the gastric glands found in the stomach wall are stimulated to secrete gastric juice. Gastric juice is composed chiefly of mucous, hydrochloric acid, and a protein-digesting enzyme pepsinogen.

Functions of Hydrochloric acid:

Hydrochloric acid converts the inactive enzyme pepsinogen into its active form i.e. pepsin. HCl also kills microorganisms present in food. Pepsin partially digests the protein portion of food (bulk of mutton) into polypeptides and shorter peptide chains.

Churning action:

In the stomach, food is further broken apart through a process of churning. The walls of the stomach contract and relax and these movements help in thorough mixing of the gastric juice and food. The churning action also produces heat which helps to melt the lipid content of the food.

Note: The starch in our bite of bread and the protein in mutton have been partially digested and the food has been converted to a soup-like mixture called chyme. After it, the pyloric sphincter allows a little mass of chyme to enter duodenum.

Small Intestine – (Complete digestion and absorption):

Function of Small Intestine:

Duodenum comprises of the first 10 inches (25 cm) of the small intestine and it is the part of the alimentary canal where most of the digestive process occurs. Here the food is further mixed with 3 different secretions;

1. Bile from liver helps in fat digestion through emulsification.
2. Pancreatic juice from pancreas contains enzymes **trypsin**, pancreatic amylase and lipase which digest proteins, carbohydrates and lipids respectively.
3. Intestinal juice from the intestine walls contains many enzymes for the complete digestion of all kinds of food.

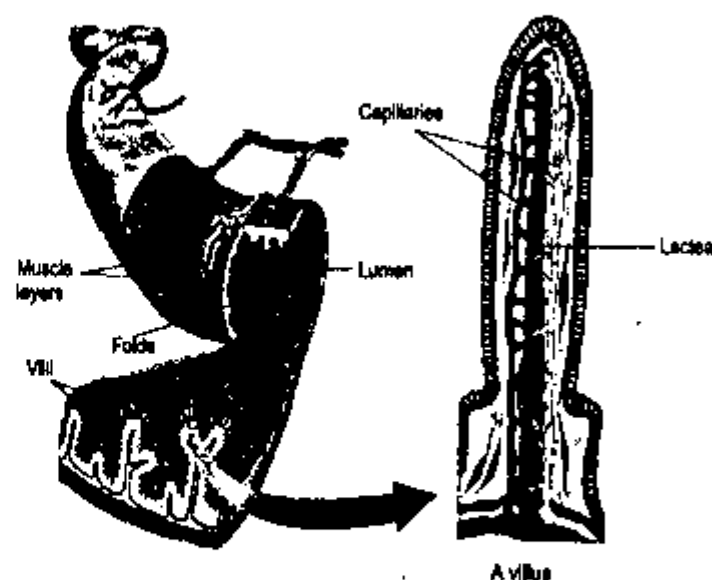
Jejunum: Next to the duodenum is 2.4 meters long jejunum. It is concerned with the rest of the digestion of the proteins, starch and lipids of our bite.

Function of Ileum: Last 3.5 meters long part of the small intestine is the ileum. It is concerned with the absorption of digested food.

Function of Villi:

There are circular folds in the inner wall of the ileum. These folds have numerous fingerlike projections called villi (singular: villus). The villi increase the surface area of the inner walls and it helps a lot in the absorption of digested food.

Each villus is richly supplied with blood capillaries and a vessel of lymphatic system, called lacteal. The walls of the villus are only single-cell thick. The digested molecules i.e. simple sugars and amino acids are absorbed from the intestine into the blood capillaries present in villi. The blood carries them away from the small intestine via the hepatic portal vein and goes to the liver for filtering, removal of toxins, and nutrient processing. Fatty acids and glycerol are absorbed into the lymphatic vessel (lacteal) present in villi which carries



Folds and villi in small intestine

Large intestine – (Absorption of water and defecation)

After the digested products of our bite have been absorbed in blood, the remaining mass enters the large intestine.

Parts of Large intestine:

It has 3 parts;

1. The caecum (or pouch that forms the T-junction with the small intestine).
2. The Colon.
3. The rectum.

From colon water is absorbed into blood. As the water is absorbed, the solid remains of the food are called **faeces**. The faeces contain the undigested material.

A large number of bacteria, sloughed off cells of the alimentary canal, bile pigments and water are also part of the faeces. Faeces are temporarily stored in the rectum, which opens out through anus. Under normal conditions when the rectum is filled up with faeces, it gives rise to a reflex and anus is opened for defecation.

Q6. (a) Which foods contain calcium and iron and what role these minerals play in our bodies?

Ans: Role of Calcium:

Calcium is essential for the development and maintenance of bones and teeth. It is also needed for maintaining cell membranes and connective tissues and for the activation of several enzymes. Calcium also aids in blood clotting.

Food sources of Calcium: Humans get calcium from milk, cheese, egg yolk, beans, nuts, cabbage etc.

Deficiency of Calcium:

Deficiency of calcium causes spontaneous discharge of nerve impulses which may result in tetany, bones also become soft, blood clots slowly and wounds heal slowly.

Role of Iron:

Iron plays a major role in oxygen transport and storage. It is a component of haemoglobin in red blood cells and myoglobin in muscle cells. Cellular energy production also requires iron. It acts as cofactor for many enzymes of cellular respiration. Iron also supports immune function.

Food sources of Iron:

Humans get iron from red meat, egg yolk, whole wheat, fish, spinach, mustard etc.

Deficiency of Iron:

Iron deficiency is the most common nutrient deficiency worldwide. Iron-deficiency causes anaemia.

(b) Write a note on process of digestion in human.

Ans: Digestion:

Our cells require oxygen, water, salts, amino acids, simple sugars, fatty acids, and vitamins. These can cross cell membranes to enter cells. Amino acids, simple sugars and fatty acids are rare in our environment. Such substances are usually parts of larger molecules like proteins, polysaccharides and lipids, which cannot cross the membranes. There is a need of converting such large and non-diffusible molecules into smaller and diffusible molecules (that can cross the membranes). This is achieved through the process of digestion.

The diffusible molecules from the digestive system reach body cells through blood. Here, they are assimilated (to get energy and to synthesize our own structures). At the same time, the indigestible part of food is eliminated out of body through the process of defecation.

Phases of Nutrition in human:

Nutrition in humans occurs in five phases namely ingestion, digestion, absorption, assimilation and defecation.

1- Ingestion	The process of taking in food.
2- Digestion	The process of breaking up complex substances into simpler substances.
3- Absorption	Diffusion of digested food into blood and lymph.
4- Assimilation	Conversion or incorporation of absorbed simple food into the complex substances

Important Questions and Answers

Q1. What are the health risks if we take more saturated fatty acids in our diet?

OR

How cholesterol level increases and what are its side effects?

Ans: Saturated fatty acids can increase a person's cholesterol level. An increased cholesterol level may eventually result in the clogging of arteries and, ultimately, heart disease.

Q2. Which of the major components of food is needed as the main structural component of the body?

Ans: Proteins.

Q3. How can we prevent our body from hypertension and kidney stones?

Ans: Good calcium nutrition, along with low salt and high potassium intake, prevents from hypertension and kidney stones.

Q4. What is the function of fibre supplement such as ispaghol husk?

Ans: Fibre supplements (such as ispaghol husk) should be used only with a physician's recommendations. Taken properly, these supplements may help in constipation and in lowering cholesterol levels.

Q5. A physician advises us; "You should start taking whole wheat bread instead of enriched white bread". The purpose of this advice is that we should take more ____ (component of food).

Ans: Dietary Fibre.

Q6. Enlist the responsibilities of digestive system?

Ans: Responsibilities of digestive system:

Our digestive system is responsible for the ingestion of food, its digestion into diffusible molecules, absorption of digested food, and the elimination of indigestible material.

Q7. What is the function of vitamin K?

Ans: Many bacteria live in colon. They produce vitamin K, which is necessary for the coagulation of blood.

Q8. Functions of the large intestine include the elimination of faeces and ____?

Ans: Absorption of water and salts.

Q9. If due to any reason, the direction of peristalsis reverses, what would be the result?

Ans: Vomiting.

Q10. In which part of the alimentary canal, the maximum absorption of nutrients occurs?

Ans: Small intestine.

Q11. Write in correct sequence the parts of the alimentary canal where digestion of proteins, lipids and carbohydrates begins.

Ans: Stomach, small intestine, oral cavity.

Q12. Why we should avoid the routine non-medical use of laxatives?

Ans: We should avoid the routine non-medical use of laxatives as this makes us habitual and bowel action becomes dependent upon their use.

Q13. Bile contains pigments, how these pigments are eliminated from body?

Ans: Elimination of Pigments:

Bile also contains pigments that are byproducts of red blood cell destruction in the liver; these bile pigments are eliminated from the body with the faeces.

14. Describe swallowing and peristalsis?

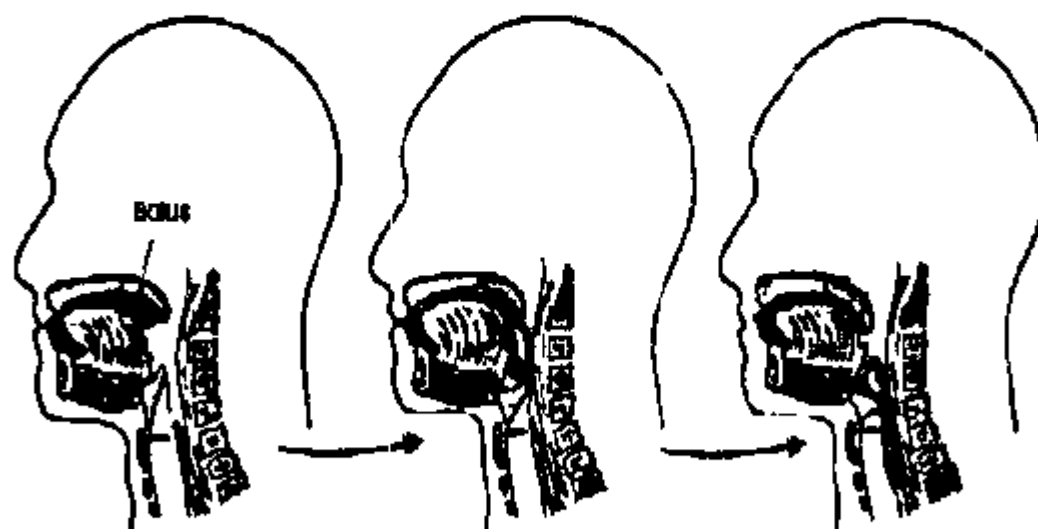
Ans: Pharynx and Oesophagus – (Swallowing and Peristalsis):

Steps in swallowing:

During swallowing, bolus is pushed to the back of mouth by tongue. When tongue pushes bolus, the soft palate also moves upward and to rear. In this way, the opening of nasal cavity is closed. When swallowed, the bolus passes pharynx to enter oesophagus. Pharynx has adaptations to prevent the entry of bolus particles

cartilage) into horizontal position. Thus glottis i.e. the opening of trachea is closed. The beginning of swallowing action is voluntary, but once food reaches the back of mouth, swallowing becomes automatic.

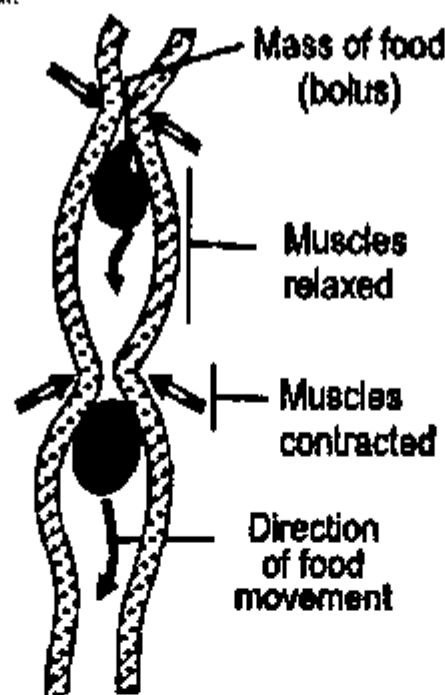
After being swallowed, the food enters the tube called the oesophagus, which connects the pharynx to the stomach. Neither the pharynx nor the oesophagus contributes to digestion and the previous digestive actions of saliva continue.



Steps in swallowing

Steps in Peristalsis:

Peristalsis moves the food from the oral cavity to the rectum. Peristalsis is defined as the rhythmic sequence of waves of contraction in the smooth muscles of the walls of alimentary canal, thus squeezing the food down along the alimentary canal.



Peristalsis

Chapter # 9

Transport

Topics Included:

- Transpiration (173)
(Opening and Closing of Stomata Excluded, Factors Affecting the Rate of Transpiration Excluded)
- Significance of Transpiration (176)
- Transport in Human (184)
- Blood (185-187) (Table 9.2 Excluded)
- Human Heart (192-193)
- Pulmonary and systemic Circulation (193)
- Heartbeat (194-195)
- Heart Rate and Pulse Rate (195-196)
- Blood Vessels (197-198) (Table 9.1 Included)

GUESS PAPER & MODEL PAPER # 9 BASED ON CHAPTER # 9 (Reduced Syllabus) TRANSPORT

BIOLOGY SSC-I SECTION-A

Time allowed: 20 Minutes

Marks: 12

NOTE:- Section-A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 20 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q.1 Encircle the correct option i.e. A / B / C / D. All parts carry equal marks.

- In most plants the food is transported in the form of;
A. Glucose B. Sucrose C. Starch D. Proteins
- Stomata close when the guard cells;
A. Lose water B. Gain chloride ions
C. Become turgid D. Gain potassium ions
- Trace the pathway of water from the soil through the plant to the atmosphere.
A. Endodermis, cortex, epidermis, vessel elements, intercellular spaces in mesophyll, stomata
B. Epidermis, endodermis, phloem, cortex of leaf, intercellular spaces of mesophyll, stomata
C. Root hairs, epidermis, cortex, xylem, endodermis, intercellular spaces in mesophyll, stomata
D. Root hairs, cortex, endodermis, vessel elements, intercellular spaces in mesophyll, stomata
- When fibrinogen makes blood clot it separates from blood and the remainder is called;
A. Plasma B. Lymph C. Serum D. Puss
- What is correct about human red blood cells?
A. Have limited life span B. Are capable of phagocytosis
C. Produce antibodies D. Are multinucleate
- Which of the following tissue layer is found in all blood vessels?

- vii. When do the atria contract?
A. Before diastole
B. After systole
C. During diastole
D. During systole
- viii. Which of the following contains deoxygenated blood in an adult human?
A. Left atrium
B. Pulmonary artery
C. Pulmonary vein
D. All of the above
- ix. Which of the following chambers has the thickest walls in human heart?
A. Right atrium
B. Left atrium
C. Left ventricle
D. Right ventricle
- x. Which of these statements is correct about the circulatory system?
A. It transports hormones
B. Capillaries have thicker walls than veins
C. Systemic circulation carries blood to and from the lungs
D. All of the above are true
- xi. Exchange of materials between blood and surrounding tissues occurs in;
A. Arteries
B. Veins
C. Capillaries
D. All of the above
- xii. Which of the following is a type of leukocyte?
A. Macrophage
B. Eosinophil
C. Monocyte
D. All of the above

BIOLOGY SSC-I

Time allowed: 2:40 Hours

Total Marks: 53

NOTE: Answer any six parts from Section 'B' and attempt any five parts from Section-C. Attempt any two questions from Section 'D' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

SECTION-B (Marks 18)

- Q.2 Attempt any SIX parts from the following. All parts carry equal marks. Be brief and to the point. (6 × 3 = 18)
- (i) What are lenticels and where are they found in plant body?
 - (ii) What is transpiration? Where does it occur.
 - (iii) Define diastole.
 - (iv) What do you mean by source and sinks according to the pressure flow mechanism?
 - (v) What are the two main types of white blood cell? How do they differ?
 - (vi) You see pus at the site of infection on your skin. How is it formed?
 - (vii) What role does the pericardial fluid play?
 - (viii) Define the term systole.

SECTION-C (Marks 15)

- Q.3 Attempt any FIVE parts from the following. All parts carry equal marks. Be brief and to the point. (5 × 3 = 15)
- (i) What are the blood vessels.
 - (ii) Describe the structure and function of arteries in the human body.
 - (iii) Describe the structure and function of capillaries in the human body.
 - (iv) Describe the structure and function of veins in the human body.
 - (v) Draw the structural diagram of blood vessels.

SECTION-D (Marks 20)

Note: Attempt any TWO questions. All questions carry equal marks.

(2 × 10 = 20)

- Q.4 What four chambers make the human heart and how blood flows through these chambers?
Q.5 Transpiration is a necessary evil. Give comments.
Q.6 List the functions of the components of blood.

SOLUTION OF GUESS PAPER & MODEL PAPER # 9 (Reduced Syllabus)

SECTION- A (MCQs)

i. B	ii. A	iii. D	iv. C	v. A	vi. B
vii. D	viii. B	ix. C	x. A	xi. C	xii. D

SECTION-B (Marks 18)

Time allowed: 2:40 Hours

Total Marks: 53

NOTE: Answer any six parts from Section 'B' and attempt any five parts from Section-C. Attempt any two questions from Section 'D' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

Q.2 Attempt any SIX parts from the following. All parts carry equal marks. Be brief and to the point. (6 × 3 = 18)

(i) What are lenticels and where are they found in plant body?

Ans: One of the small areas on the surface of the stems and roots of woody plants that allow the interchange of gases between the metabolically active interior tissue and the surrounding air or pockets of air in the soil. Lenticels present in the stems of some plants.

(ii) What is transpiration? Where does it occur.

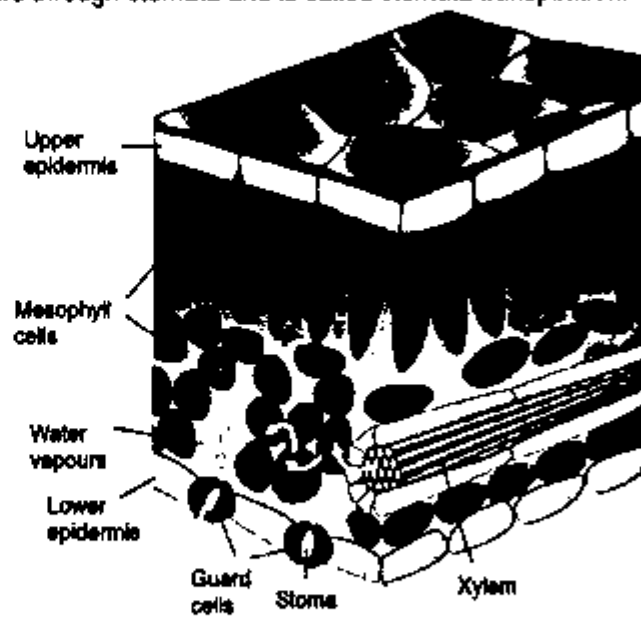
Ans: Transpiration:

Transpiration is the loss of water from plant surface through evaporation. This loss may occur through stomata in leaves, through the cuticle present on leaf epidermis, and through special openings called lenticels present in the stems of some plants.

Stomata Transpiration: Most of the transpiration occurs through stomata and is called stomata transpiration.

Explanation:

The mesophyll cells of leaf provide large surface area for the evaporation of water. Water is drawn from xylem into mesophyll cells, from where it comes out and makes a water-film on the cell walls of mesophyll. From here, water evaporates into the air spaces of the leaf. Water vapours then diffuse from air spaces towards stomata and then pass to outside air (Figure).



(iii) Define diastole.

Ans: Diastole:

Diastole is the period of time when the heart fills with blood after systole (contraction). Ventricular diastole is the period during which the ventricles are relaxing, while atrial diastole is the period during which the atria are relaxing. The term *diastole* originates from the Greek word meaning dilation.

(iv) What do you mean by source and sinks according to the pressure flow mechanism?

Ans: Sources include the exporting organs, typically a mature leaf or storage organ. Sinks are the areas of active metabolism or storage e.g. roots, tubers, developing fruits and leaves, and growing regions.

(v) What are the two main types of white blood cell? How do they differ?

Ans: White Blood Cells (Leukocytes):

These are colourless, because they do not contain pigments. They are not confined to blood vessels and also migrate out into tissue fluid. One cubic millimeter of blood contains 7000 to 8000 WBCs. Their life span ranges from months to even years, depending on body's needs. WBCs function as the main agents in body's defence system.

Types of white blood cell:

There two main types of WBCs.

Granulocytes have granular cytoplasm. These include **neutrophils** (destroy small particles by phagocytosis), **eosinophils** (break inflammatory substances and kill parasites) and **basophils** (prevent blood clotting).

Agranulocytes have clear cytoplasm and include **monocytes** (produce macrophages which engulf germs) and **B and T lymphocytes** (produce antibodies and kill germs).

(vi) You see pus at the site of infection on your skin. How is it formed?

Ans: Pus is a whitish-yellow, yellow, or brown-yellow protein-rich fluid called liquor puris that accumulates at the site of an infection. It consists of a buildup of dead, white blood cells that form when the body's immune system responds to the infection.

OR (Second Answer)

The formation of pus is caused by the death of tissues and white blood cells surrounding an infection in the body.

(vii) What role does the pericardial fluid play?

Ans: The pericardial fluid reduces friction within the pericardium by lubricating the epicardial surface allowing the membranes to glide over each other with each heart beat.

(viii) Define the term systole.

Ans: Systole:

The time at which ventricular contraction occurs is called systole. systole is the contraction of the chambers of the heart, driving blood out of the chambers. The chamber most often discussed is the left ventricle. However, all four chambers of the heart undergo systole and diastole in a timed fashion so that blood is propelled forward through the cardiovascular system.

SECTION-C (Marks 15)

Q.3 Attempt any FIVE parts from the following. All parts carry equal marks. Be brief and to the point.

(5 × 3 = 15)

(i) What are the blood vessels.

Ans: Blood Vessels:

The third part of blood circulatory system are blood vessels, which function to transport blood throughout body. The most important vessels in blood circulatory system are arteries, veins, and capillaries.

(ii) Describe the structure and function of arteries in the human body.

Ans: Arteries:

Arteries are the blood vessels that carry blood away from heart. In adults, all arteries with the exception

elastic tissue while the innermost layer is made up of endothelial cells. The hollow internal cavity in which blood flows is called lumen.

When arteries enter body organs, they divide into smaller vessels known as arterioles. Arterioles enter tissues and divide into capillaries.

(iii) Describe the structure and function of capillaries in the human body.

Ans: **Capillaries:**

Capillaries are the smallest blood vessels present in tissues. These are formed by the divisions of arterioles. The exchange of materials between blood and tissue fluid is carried out through capillaries.

Structure of Capillaries:

The walls of capillaries are composed of only a single layer of cells i.e. endothelium. This layer is so thin that molecules of the digested food, oxygen and water etc. can pass through them and enter tissue fluid. Waste products such as carbon dioxide and urea can diffuse from tissue fluid into blood.

Note: Capillaries are so small that the red blood cells need to partially fold into bullet-like shapes in order to pass through them in single file.

(iv) Describe the structure and function of veins in the human body.

Ans: **Veins:**

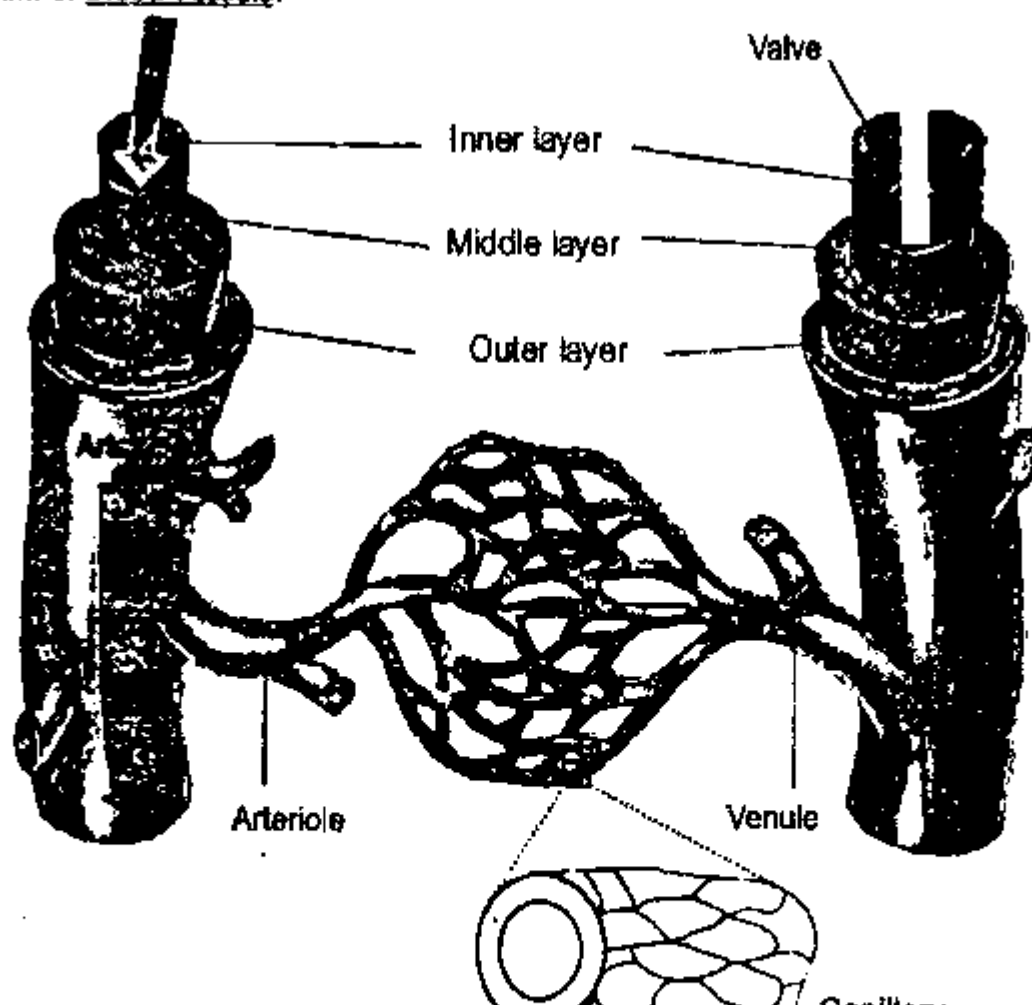
A vein is a blood vessel that carries blood towards heart. In adults, all veins with the exception of pulmonary veins, carry deoxygenated blood.

Structure of Veins:

Veins are also well-adapted to their function. The walls of vein are composed of the same three layers as are present in artery wall, with the difference that the middle layer of vein has less smooth muscles and elastic tissue as compared to artery. So the middle layer of vein is comparatively thin. The lumen of the veins is broader than that of arteries.

(v) Draw the structural diagram of blood vessels.

Ans: **Diagram of Blood vessels:**



(vi) Compare an artery, a vein and a capillary.

Ans: Table: Comparison of arteries, capillaries and veins:

Characteristics	Arteries	Capillaries	Veins
Function	Carry blood away from heart	Allow the exchange of materials between blood and tissues	Carry blood towards heart
Thickness and Elasticity in walls	Thick and elastic	One-cell thick non-elastic walls	Thin and less elastic
Muscles in walls	Thick	No muscles	Thin
Blood pressure	High BP	Medium	Low BP
Valves	No valves	No valves	Valves present

(vii) Differentiate between Pulmonary and Systemic circulation.

Ans: Pulmonary circulation:

The pathway on which deoxygenated blood is carried from heart to lungs and in return oxygenated blood is carried from lungs to heart is called pulmonary circulation or circuit.

Systemic circulation:

Similarly, the pathway on which oxygenated blood is carried from heart to body tissues and in return deoxygenated blood is carried from body tissues to heart is called systemic circulation or circuit.

SECTION-D (Marks 20)

Note: Attempt any TWO questions. All questions carry equal marks. (2 × 10 = 20)

Q.4 What four chambers make the human heart and how blood flows through these chambers?

Ans: Heart: Heart is a muscular organ responsible for pumping blood through blood vessels by repeated contractions.

Cardiac muscles:

The term "cardiac" means "related to the heart". The bulk of the walls of heart chambers is made of cardiac muscles.

Recalling: Cardiac muscles are involuntary in action and are composed of branched striated cells, each with a single nucleus.

Location of heart:

In human body, heart is situated between lungs, in the middle of chest cavity (thorax) under breastbone.

The heart is usually felt to be on the left side because the left chamber of the heart i.e. (left ventricle) is stronger (it pumps blood to all body parts).

Pericardium: Heart is enclosed in a sac known as pericardium

Pericardial fluid:

There is a fluid, known as pericardial fluid, between pericardium and heart walls. It reduces friction between pericardium and heart, during heart contractions.

Structure of Human Heart:

Human heart consists of four chambers, like the heart of birds and other mammals.

Left and right atria: The upper thin-walled chambers are called left and right atria (singular 'atrium').

Left and right ventricles: The lower thick-walled chambers are called left and right ventricles.

Left ventricle is the largest and strongest chamber in heart.

The walls of left ventricle are the thickest one. These are about a halfinch thick. They have enough force to push blood into the body. This gives an evidence that the structures of the parts of heart are adaptive to their functions.

Blood flow through the chambers:

Function of right atrium:

Right atrium receives deoxygenated blood from body via the main veins i.e. superior and inferior vena cavae. When right atrium contracts it passes the deoxygenated blood to right ventricle.

Both atria are filled simultaneously. They contract together to pump the blood to both the ventricles. Similarly, both ventricles contract simultaneously to pump the blood out of heart.

Tricuspid valve:

The opening between right atrium and right ventricle is guarded by a valve known as tricuspid valve (because it has 3 flaps).

When right ventricle contracts, the blood is passed to pulmonary trunk, which carries blood to lungs. Tricuspid valve prevents the backflow of blood from right ventricle to right atrium.

Semilunar valve:

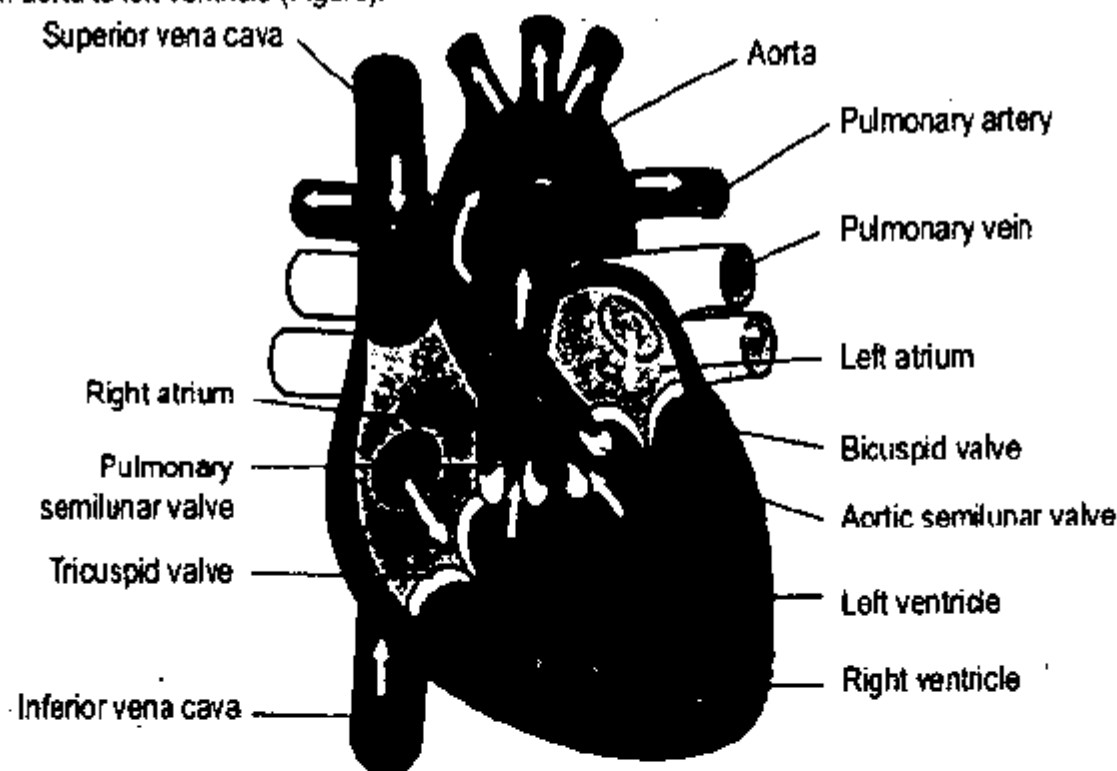
At the base of pulmonary trunk, pulmonary semilunar valve is present which prevents the backflow of blood from pulmonary trunk to right ventricle.

Function of left atrium:

The oxygenated blood from lungs is brought by pulmonary veins to left atrium. Left atrium contracts and pumps this blood to left ventricle.

Bicuspid valve:

The opening between left atrium and left ventricle is guarded by a valve known as bicuspid valve (because it has two flaps). When left ventricle contracts, it pumps the oxygenated blood in aorta, which carries blood to all parts of body (except lungs). Bicuspid valve prevents the backflow of blood from left ventricle to left atrium. At the base of aorta, aortic semilunar valve is present which prevents the backflow of blood from aorta to left ventricle (Figure).



Human heart; structure and blood flow

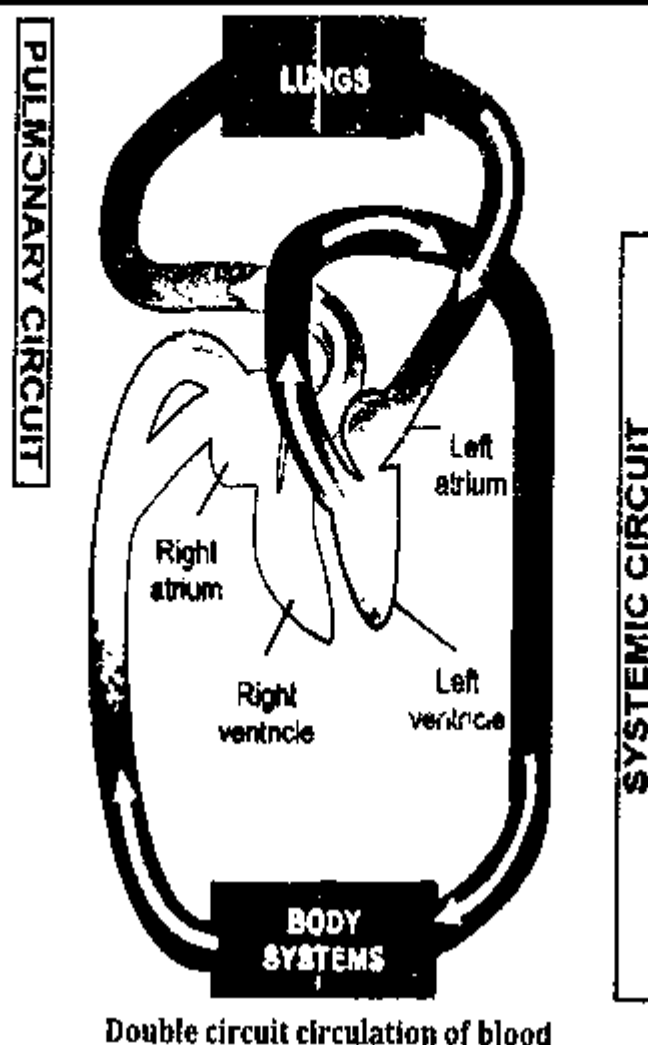
Pulmonary and systemic circulation:

Collection of deoxygenated and oxygenated blood:

We see that right side of heart collects deoxygenated blood from body and distributes it to lungs while left side collects oxygenated blood from lungs and distributes it to body.

Pulmonary circulation:

The pathway on which deoxygenated blood is carried from heart to lungs and in return oxygenated blood is carried from lungs to heart is called pulmonary circulation or circuit (Figure)



Double circuit circulation of blood

The blood in pulmonary circulation is at lower pressure than the blood in systemic circulation. It gives sufficient time to blood for gaseous exchange in lungs.

Q.5 Transpiration is a necessary evil. Give comments.

Ans: Transpiration is called a necessary evil. It means that transpiration is a potentially harmful process but is unavoidable too.

Significance of Transpiration:

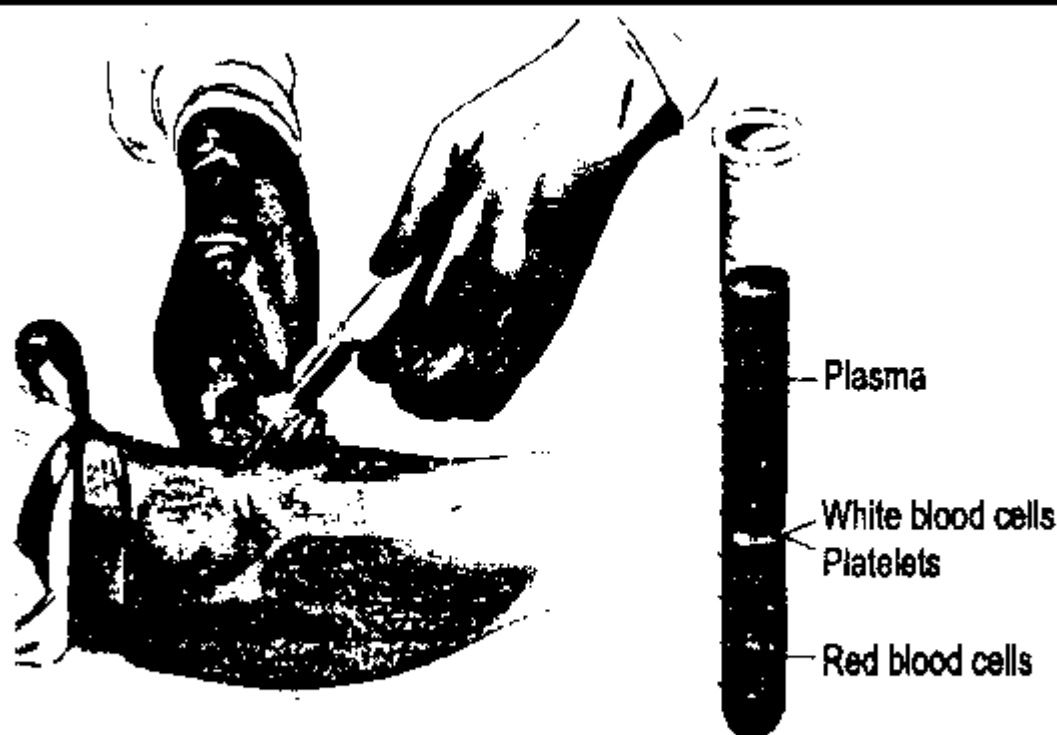
- Transpiration is called a necessary evil. It means that transpiration is a potentially harmful process but is unavoidable too.
Transpiration may be a harmful process in the sense that during the conditions of drought, loss of water from plant results in serious desiccation, wilting and often death.
- On the other hand, transpiration is necessary too. It creates a pulling force called **transpirational pull** which is principally responsible for the conduction of water and salts from roots to the aerial parts of plant body.
- When water transpires from the surfaces of plant, it leaves a cooling effect on plant. This is especially important in warmer environments. Moreover, the wet surfaces of leaf cells allow gaseous exchange.

Note: There is strong evidence that even mild water stress results in reduced growth rate.

Q.6 List the functions of the components of blood.

Ans: Blood:

Blood is a specialized body fluid (a connective tissue) that is composed of a liquid called blood plasma and blood cells. The weight of blood in our body is about 1/12th of our body. The average adult body has about



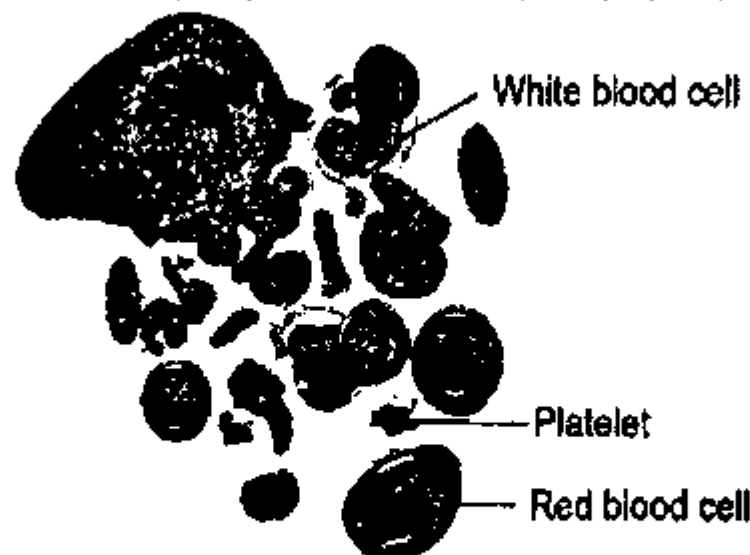
Percentage composition of human blood

Blood Plasma:

Plasma is primarily water in which proteins, salts, metabolites and wastes are dissolved. Water constitutes about 90-92% of plasma and 8-10% are dissolved substances. Salts make up 0.9 % of plasma, by weight. Sodium chloride (the table salt) and salts of bicarbonate are present in considerable amounts. Ca, Mg, Cu, K and Zn are found in trace amounts. Changes in the concentration of any salt can change the pH of blood (normal is 7.4). Proteins make 7-9 % by weight of plasma. The important proteins present in plasma are antibodies, fibrinogen (blood clotting protein), albumin (maintains the water balance of blood) etc. Plasma also contains the digested food (absorbed from digestive system), nitrogenous wastes and hormones. Respiratory gases i.e. CO_2 and O_2 are present in the plasma.

Blood Cells and cell-like bodies:

These include red blood cells (erythrocytes), white blood cells (leukocytes) and platelets (thrombocytes).



Different cells and cell – like bodies in blood plasma

Red Blood Cells (Erythrocytes):

About 95% of the cytoplasm of RBCs is filled with hemoglobin, which transports O_2 and small amounts of CO_2 . The remaining 5% consists of enzymes, salts and other proteins. RBCs are biconcave and have an elastic cell membrane. In the embryonic and foetal life, they are formed in liver and spleen. In adults, they are formed in the red bone marrow of short and flat bones, such as sternum, ribs and vertebrae. Average life span of RBC is about four months (120 days) after which it breaks down in liver and spleen by phagocytosis.

In a normal person about 2-10 million red blood cells are formed and destroyed every second.

White Blood Cells (Leukocytes):

These are colourless, because they do not contain pigments. They are not confined to blood vessels and also migrate out into tissue fluid. One cubic millimeter of blood contains 7000 to 8000 WBCs. Their life span ranges from months to even years, depending on body's needs. WBCs function as the main agents in body's defence system. There are two main types of WBCs.

Granulocytes have granular cytoplasm. These include **neutrophils** (destroy small particles by phagocytosis), **eosinophils** (break inflammatory substances and kill parasites) and **basophils** (prevent blood clotting).

Agranulocytes have clear cytoplasm and include **monocytes** (produce macrophages which engulf germs) and **B and T lymphocytes** (produce antibodies and kill germs).

Platelets (Thrombocytes):

They are not cells, but are fragments of large cells of bone marrow, called megakaryocytes. They do not have any nucleus and any pigment. One cubic millimeter of blood contains 250,000 platelets. The average life span of a blood platelet is about 7 to 8 days. Platelets help in blood clotting. The clot serves as a temporary seal at the damaged area.

WBCs die in the process of killing the germs. These dead cells accumulate and make the white substance called pus, seen at infection sites.

In dengue fever, there is a sharp decrease in the number of platelets in blood. Because of this, patients bleed from the nose, gums and under the skin.

